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AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Engineering Library

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Advertisers' Index—Next to Last Page

PUBLISHED WEEKLY AT 239 WEST 39TH STREET, U. P. C. BUILDING, NEW YORK CITY, N. Y.

Back view showing mirror included at no extra cost.

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A 3¼ inch reducing mirror, included at no extra cost, is located in the center of the back. It is not necessary to twist the light at an unsightly angle to use mirror. The switch is located conveniently so the hand finds it instantly in the dark.

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Both its handsome appearance and complete utility recommends it. It has high quality and finish all the way through. Its low price $5.00—is not an indication of quality, but a tribute to the Stewart Organization, which makes quality accessories at popular prices possible through large quantity production.

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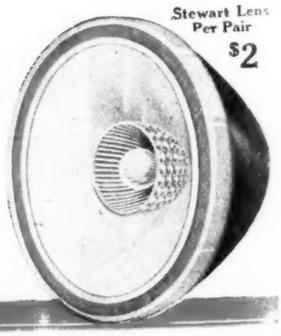


Stewart Lens Per Pair $2

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XXXIX NEW YORK, THURSDAY, SEPTEMBER 12, 1918—CHICAGO NO. 11

Offered Aid of Allies Not Accepted by Aircraft Authorities

Foreign Missions Sent to America to Give Advice and Assist in Work Are Not Consulted

SUGGESTED SUBJECTS FOR A REAL AIRCRAFT INVESTIGATION

By Allen Sinsheimer

WASHINGTON, Sept. 10—Although airplane matters have been very quiet since the Labor Day holiday, the recent cancellation of the Caproni contract for manufacturing bombing planes and other steps in the selection of types of planes to build have added to the confusion of the situation and force many to ask why an investigation should not answer some of the questions with regard to types of planes that have not been touched upon in the Senate Committee report.

The Foreign Aviation Missions now in this country to assist in the airplane program are amazed and quite at sea because of many things that have recently happened in connection with the work and they see very little if any use for remaining in this country when their recommendations are given so little consideration.

It is gossiped in Washington circles that an investigation which shows something will be worth while and very desirable. There are many subjects that might be answered, in fact, that should be answered, whether an investigation is necessary to secure these answers or not. There should be answers forthcoming which would explain the reasons for some of the following:

1—The 8 months' delay and indecision on the Nieuport 15-metre scout.

2—The selection of the Bristol scout discarded long ago by Great Britain.

3—The large orders for the 80 hp. Rhone engines.

4—The selection of the SE5, long since discarded by England.

5—The refusal by this country of thousands of SE 5's offered by England.

6—The complete cancellation of the Caproni program.

7—The bewilderment and discouragement of our Allied air experts in this country.

8—The apparent lack of regard for the opinions of the Allied aviation missions by our aeronautical divisions.

9—The reports that numerous engineers are given carte blanche to improve their inventions while discrediting all other suggestions.

10—The frequent charges that there are too many engineers with individual preference, too many authorities and too little decision.

Eight months ago following a conference between American and foreign heads of the air divisions, decision was made to adopt the Nieuport 15-metre scout for training pursuit pilots in this country. It was to be equipped with the 80 hp. Le Rhone engine.

After 8 months of absolute inactivity, it has been announced that the Nieuport program is abandoned and that the British Bristol scout has been adopted in its place. The Bristol scout is 3 years behind in the British program. It has been discarded for a new Bristol far superior. The Bristol scout has a speed of 80 m.p.h. and a ceiling of 10,000 ft., while the Nieuport has a speed of 106 m.p.h. and a ceiling of 17,000 ft. equipped with the same engine.

British experts join in the declaration that of the two machines the Nieuport is far superior.

French officials are dumfounded at the substitution of the Bristol for the Nieuport. They are at a loss to understand it. It is reported here that the chief reason for using any such machine as the Bristol is the large order placed sometime ago for the 80 h.p. Le Rhome engines. The authorities do not know what to do with the quantities of these engines, it is said, and are therefore taking on the Bristol scout.

England Discarded the SE 5

Recently, announcement was made that the SE 5 was officially adopted for the American airplane program. As soon as this announcement reached England, a very high British official cabled that England had long discarded this plane and had 5000 or 6000 on hand which would be sold to this country reasonably. Our officials replied refusing the offer, stating that we will build them in great quantities and have no use for the several thousand on hand in England. With no explanation, this reply leaves the British confused.

The SE 5, as was told before in these columns, has not only been discarded by England as long ago as September, 1917, but was discarded for the SE 5 A, which had a higher speed and all around better performance and which in turn was superseded by the Sopwith Camel, discarded for the Sopwith Dolphin, replaced by the Sopwith Snipe. Each of these machines in turn has been regarded as superior to the preceding one by the British experts. We have selected a machine in the SE 5 which has been replaced four times over and which was called obsolete 1 year ago.

Reasons for Caproni Cancellation

Politics and business influences are rumored to be the cause of the Caproni program cancellation. Although it is conceded by everyone that bombing planes in great quantities will certainly hurry the end of the war; although Caproni planes tested with Liberty engines have been proven even better than the Caproni equipped with the Fiat engine; although Italian experts from the Caproni plant have been in this country for months, there has been only delay and indecision and now, finally, we have complete cancellation of the plans for Caproni plane construction. And the Italian authorities appeared to be as much at a loss to understand the cancellation as the average citizen.

The British, French and Italian air missions are, of course, delicately situated and unable freely to express opinions, but it is an open secret that they are alarmed and discouraged with American air activities. Many valuable men, needed in their own countries, sent here to give us the benefit of their experiences, sit in their offices, unable to gain hearings with the American officials, wasting their time O.K.ing blueprints that are never used and rejecting others embodying numerous foolish practices. When they can be induced to talk they tell of the many engineers who will approve only their own ideas, of the lack of definite authority, of the inability to make a decision and stand by it.

Allies Approve Liberty Engine

The Allied experts all approve our Liberty engine. They will take all they can get of them. They are amazed at our great production which is steadily climbing toward the peak. But witnessing this remarkable performance on one hand, thoroughly converted to our standardization and plans for few models, they are unable to connect the efficiency shown here with the confusion that exists as regards all of the other operations.

They are unable to understand the speedy engineering and production of the Liberty engine and the principles of standardization, with our delay and procrastination in plane production and our present plans which point toward a program of many types of planes.

One engineer sent to this country was at first an ardent believer in quality as against quantity. He has changed his ideas. After witnessing the hampered production here, due to the constant improvements suggested to their inventions by our engineers who have been given carte blanche, he has turned to the German plan of producing few types in great quantities. His investigations over here, his contact with our officials and his experiences have led him to make suggestions which he cannot personally offer in his official capacity.

Suggests a Business Head

He suggests the appointment of a thoroughly capable business man, "one who has had to do with automobile production," to the head of all aircraft work with absolute power.

This man should then call together the British, French and Italian airplane engineers for conference with the American engineers to decide on three types of machines or as many as they decided necessary. He believes in the use of three types:

a—Pursuit machines (single seaters).

b—Artillery and reconnaissance machines (2-seaters).

c—Long distance bombing machines (double engine, 4 or 6 seaters).

In collaboration with these experts, he further recommends the fixing of a schedule of performance necessary for the machines of each type before they can be adopted. For example:

A pursuit machine before adoption and production must exceed certain speeds at certain heights, climb to specified heights in a certain number of minutes and display certain endurance powers.

After the schedules of performance have been decided upon they should be duplicated and copies sent to each airplane firm in the country. The firms

themselves could then design their own machines to meet or exceed the performance.

In consequence of this plan there would be different firms in all sections of the country striving to produce the best possible machines, some building pursuit planes, some bombing planes and others reconnaissance planes. When the machines are finished the firms would notify the aircraft headquarters which, in turn, would order them sent to a central testing ground.

The result would be a large number of all the necessary types of planes awaiting the tests. The best of each type would be selected after thorough trials, the machine exceeding the schedule over all its competitors being the one selected. This one in each type would be universally adopted as the standard plane and put into production.

A plan of this sort would eliminate design of all planes by a few men as is now the case. It would prevent the constant tinkering and attempts at improvement which hinder production. It would insure a machine equal or better than the requirements set by the original conference, and while this plane is in production and in service further improvements which would not hamper production or newer and better designs of planes could be studied for the later program.

Whether these suggestions are adopted or not, there must be some radical changes. Recently the chief official of the military air section testified before Congressmen that the SE 5 is a two-passenger machine, when as a matter of fact it is a single seater. He compared it to the Spad, although it is completely different in performance, appearance and horsepower.

With the airplane program vitally important in the successful prosecution of the war, it is most urgent that we have men at the head of this work who thoroughly understand it and that we have some definite policy under the control of such an executive.

A secretary of Aircraft with full power to act, versed in internal combustion engines, broad enough to appreciate the value of the foreign experts, combined with some such plan and organization as is suggested, will probably insure speedy and successful fulfillment of the airplane program. Certainly it could not allow for the existing confusion and delay.

Without doubt many other apparently unreasonable activities like those and equally bewildering and confusing will be found. The men responsible must be removed. The proper organization and plan must be determined. Thoroughly trained competent men must direct the work. In this way only can we achieve the success that is expected.

Keeping Track of Labor Turnover

In Plants Where Semi-Skilled Men Must Be Trained to Meet Labor Needs, a Careful Compilation and Analysis of Turnover Records Is Worth Many Times the Expense Involved

By E. H. Fish*

MUCH has been said in the past few years regarding the high cost of a high labor turnover. There has been a tendency to attack that high cost blindly, with the idea that a reduction by whatever means must be an economy. There are, however, many cases in which the employer is much better off to be rid of an employee, and many cases in which the employer ought to wish a departing subordinate Godspeed and good luck.

No single figure, no matter what the definition of labor turnover may be, will give the general manager a true idea of what is going on in the shop or office. An analysis will.

It is probable that most concerns will find that certain departments hold their men and others do not. They will usually find that married men stay longer, on the whole, than unmarried. If the work is seasonal they sometimes find that married men shun their places. They find that men who have a deep-rooted feeling that they wish to live in that particular city stay better than men who have been in the habit of roving.

There are then two principal things which determine the analysis: the department, and the cause of leaving; or, more important yet, the reason for staying. The division by departments should be fine enough to reach the foremen, whose influence is most felt by the workmen. This is different in different shops. In some the department head is in close enough contact with the men so that any difficulty with the straw boss comes immediately to his attention. In other cases the straw boss or working foreman is the man who really determines the status of his subordinates.

Whichever it may be, we need to know definitely how well men stay under certain personalities. A great many foremen take the ground that with the dilution of labor going on all around us they cannot be blamed for the rate at which subordinates leave them. They cannot be held responsible for the whole turnover in their departments, but they themselves ought to wish to know how their departments compare with those under other foremen.

Three Classes of New Men

It is also interesting to keep watch of the new men, dividing them into three classes: those new to the shop, those who have worked there in the past and are rehired, and those who are transferred from one department to another. We are interested in these items because the number of men rehired is a very good indication of the

*Employment Manager, The Norton Co.

esteem in which the shop is held, and the number transferred is a good indication of the attempt to steady employment. No shop is quite so well able to get a high-grade of help as the shop which has a reputation for taking care of its men.

Most of us are children in business, as otherwise we would probably not be good mechanics, and we crave a certain degree of paternal treatment. To get this information it is well to classify the transfers as promotions, demotions on account of health, and those which are merely for departmental fluctuations. It is also our practice to classify the new men and those rehired as skilled, learners, and laborers. This classification, in these times, is especially desirable to show to the general manager what a large proportion of his new men must be trained in some way. Knowing the number, he may see more clearly whether it will probably pay to establish a vestibule school, or a school for training foremen to teach.

Many foremen take the unfortunate ground that once a man leaves them he has burned his bridges behind, and cannot return. The analysis shows who they are. A great help in rehiring is to have the man rated when he leaves, so that a glance at his folder, if records are kept that way, will show whether he left in such a way that he should be considered for immediate re-hiring, or whether he should be warned that he could not get back easily unless he gave a reasonable notice. This, however, depends on other conditions in the shop. There are many places where men do not give notice when they intend leaving, for the simple reason that they know from the past experience of others that they are liable to be told to "get to h— out right now."

There are other places where, if a man gives notice, he can get all his money the day he quits, which is productive of a high turnover, because every time a man feels that he would like a little more money than he ordinarily gets he gives his notice, and goes to work for our competitor the next Monday. If these things are going on in the shop unknown to the general manager, a few statistics will set him on their track.

Analysis of Reasons for Leaving

The most important thing, however, is an analysis, by departments, of the reasons for leaving. If the management knows why men leave, and in what numbers, he can tell with fair certainty how much money he can spend to cure the trouble. It is not easy to find out why men leave. Usually, it is a combination of reasons. The last one, the straw that broke the camel's back, may be the one that is given, while one that is not uppermost in the man's mind may be the fundamental one. No system of tabulation is of any value unless the management is confident that the interviewer who sees the workman has gotten to the bottom of the causes; and quite often, when he has reached the bottom, and can begin to build up on a solid foundation, he is able to retain the services of the man.

These times, the first reason we expect to see advanced is low wages. Probably half the men who leave will allege that they can get more money somewhere else. Many times they can. None of us like to knock our neighbors, especially if we both belong to the same employment managers' association. We may be very certain that this particular man cannot earn what he claims, or, if he can do it in a competitor's shop he can do it in ours, too, just as well as to move over there.

The proportion of the turnover which is found after careful inquiry to be due to the ability of our employees to get better-paying jobs, compared with the number of men returning to us after having been away to try another place, is what should determine when it is best to raise wages. This proportion will, of course, be different for every different shop and for varying conditions in the one shop, depending on whether the policy of the company is to pay for the pick of the available workmen, or whether it prefers to keep its payroll low and depend on excellence of foremanship to produce results.

Working conditions are the next thing to tabulate. By this we mean whether the work is dusty, dirty, heavy, wet, dangerous, or otherwise disagreeable and unsafe. A high proportion of labor turnover may justify the expenditure of considerable sums of money for improvement, while a low rate may prove that employees do not object to the prevailing conditions so much as the superintendent might.

One of the elusive things is the leaving due to the coolness of the social atmosphere. An office man is apt to think of this attitude as his prerogative, and not to grant the shop men the sensitiveness to notice it. It is usually one of the last straws that determines whether a man will put up with other things. It is just this one straw, however, that if removed might help keep men on the job. Other divisions under which leaving should be tabulated are housing, transportation, commissary, preference for another line of industry, living nearer home, and, naturally, now, entering Government service.

Recording Reasons for Discharges

Discharges should also be classified. If a certain department shows a large number of men discharged as "trouble breeders," the foreman may be suspected of having caused the trouble, or possibly he may be using it as a cloak to his desire to get rid of men on personal grounds. We do not tabulate the latter, as we feel that it should not be allowed. If a foreman does not like red-headed men he should say so when he sends in his requisitions.

The turnover due to unavoidable causes, such as death, protracted illness, marriage of female employees, etc., is so small as to be hardly worth recording except for the sake of completing the record; but it is also so small as to make the recording a trivial expense.

This brings us to a vital question: How much can a firm afford to pay for keeping vital statistics like these? The answer is, "It depends." If the works are run entirely by unskilled laborers, if the supply is ample, then there is little good to be obtained. If the plant is operated almost wholly by skilled men, who come already well trained, and the supply is ample, there is no great object; but if the plant is in the condition that almost every shop in the country is in to-day, where the work is being done by semi-skilled men who are being trained on the job at great expense, or in separate vestibule schools at less expense, then the saving to the shop of even a few men who would otherwise have to be replaced at anywhere from fifty dollars each up, then the profit is so great that the expense sinks out of sight. Our experience is that a good man on the job in a plant with four thousand men can save his salary and the expense of this office about ten times over.

New Duplex Instruments

IN its new catalogue on Instruments and Relays, just published, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces two new duplex instruments for battery charging, marine, dental, telegraph, telephone, farm lighting, and other compact instrument panels where direct-current is involved.

These duplex instruments consist of any two standard Westinghouse type AW or type FW instruments desired, mounted in an attractive dull-black metal case. The type AW instruments have round open faces, 3 in. in diameter, with glass cover and rear mounting studs; the type FW have 5-in. faces.

Process Refining Systems Would Increase Gasoline Production

Cost of Installing Such Apparatus Would Be Returned in 80 Days—Present Need Is for Increased Output Rather Than Curtailed Use

FIGURES on gasoline production and consumption given out by the Fuel Administrator to-day showing that since April 1, 1918, there has been a decrease in gasoline reserves of 4,119,000 barrels (barrel contains 42 gal.) must be interpreted somewhat differently from what these figures would indicate, in that gasoline is a seasonable product with a maximum consumption taking place during the period of April to September, inclusive, and with the peak load of consumption coming in June, July and August.

To understand the gasoline situation it must be remembered that the high point of storage of gasoline generally comes in April and that this storage stock gradually falls off until October, when it starts building up again to the following April.

The gasoline stock in storage during three periods of the present year bear out these figures:

	Barrels
January 1 (in storage)	9,902,000
April 1 (in storage)	15,787,000
August 1 (in storage)	8,648,000

According to the Fuel Administrator, the daily deficit or loss in stocks approximates 11,000 bbl. of 42 gal. each. The deficit in the territory east of California is 3000 bbl. per day and in the California territory 8000 bbl. per day.

These figures, given out by Fuel Administrator Garfield, were in reply to the Lodge resolution asking that figures be furnished to show the supply on hand. The complete figures for the territory east of California and also for the California territory are given herewith as presented by the Fuel Administrator.

These fuel figures are doubtless responsible for the recent requests for automobilists practically to discontinue the use of motor cars on Sundays. There is scarcely a motorist in the country who does not wish to conserve as may be necessary, but there are other viewpoints on the fuel situation which we believe the Fuel Administration should take recognition of and attempt to supply the necessary gasoline, not all by curtailment, but rather by increased productoin.

This can be accomplished by the use of a process system of manufacture, which systems are familiarly known as pressure systems and in which a pressure ranging from 75 to 110 lb. per sq. in. is used in the stills and where the temperature varies from 700° to 750° Fahr., a temperature high enough to crack the crude into gasoline and thereby greatly increase the production of gasoline from crude.

There are 30 or 40 of these process systems of gasoline refining, several of which are very practical and valuable. With three or perhaps more of these processes it is possible to double the output of gasoline from a given quantity of crude. With what is known as the skimming method, a gallon of crude oil will yield approximately ¼ gallon of gasoline, but with the process system, refining this same gallon of crude will yield approximately ½ gallon og gasoline.

At present, scarcely 20 per cent of gasoline is produced by the process system, which means that on 80 per cent of the crude used we are literally securing but 50 per cent of the gasoline from it that we should be securing. The Standard Oil Co. has been a leader in developing the process system, this particular system being the Burton, developed by Dr. W. M. Burton, chief chemist of the Standard Oil Co. of Indiana, whose refinery is at Whiting, a short distance out of Chicago. This company began manufacturing under the Burton process 7 or 8 years ago and has since licensed practically all of the other Standard Oil companies.

The majority of the other big refinery interests have not

(*Continued on page* 483)

Production and Consumption of Gasoline in the East

TERRITORY EAST OF CALIFORNIA

Gasoline and naphtha stocks, 1918—

	Barrels
Jan. 1	8,400,000
April 1 (high point)	11,000,000
Aug. 1	7,800,000
Decline in stocks	3,200,000

Estimated daily production and consumption:

Approximate daily consumption—

	Barrels
Domestic	160,000
Export	34,000
Total daily consumption	194,000
Approximate daily production	191,000
Average daily deficit	3,000

(Probable result for year ending Dec. 31, 1918.)

Records for the months of April, May, and June, combined, show the following: (July and August are not yet entirely complete.)

Approximate daily average consumption—

	Barrels
Domestic	199,000
Export	37,000
Total	236,000
Approximate daily average production	216,000
Daily deficit, April, May, June	20,000

CALIFORNIA TERRITORY

Gasoline and naphtha stocks—

	Barrels
Stocks on hand, Jan. 1, 1918	1,502,000
Stocks on hand March 1, 1918	4,787,000
Stocks on hand Aug. 1, 1918	848,000
Total decrease from high point	919,000

Daily production, consumption and export, first half of 1918:

Approximate daily consumption:

Domestic	29,000
Export	2,000
Total	31,000
Approximate daily production	28,000
Daily deficit	.000

April, May, and June, 1918, approximate daily consumption:

Domestic	33,000
Export	2,000
Total	35,000
Approximate daily production	27,000
Daily deficit	8,000

The Bennett Centrifugal Air Washer

Combines the Centrifugal Principle of Separating Dust from Air with the Water-Washing Principle

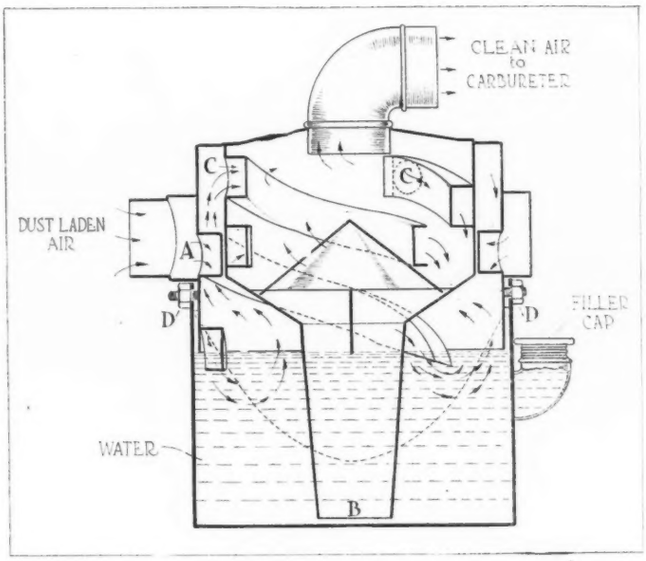
THE Bennett centrifugal air washer, a new product of the Wilcox-Bennett Carburetor Co., Minneapolis, Minn., consists essentially of a Bennett air cleaner suspended within a cylindrical casing containing a quantity of water. This water is made to revolve within the container by the whirling action of the air drawn into it from the suction of the carbureter. The water rotates because the air is drawn into it tangentially through two spiral tubes in the inner circumference of the casing.

Referring to the sectional view of the air washer, the dust laden air enters as shown and passes into the water compartment through openings in the spirals at *A*. The rapidly whirling air causes the whole mass of water to revolve so that it piles up against the sides in approximately the position shown by the dotted line. This completely submerges the lower ends of the spirals so that all the air must pass through the water before escaping upward into the openings *C* of the inner air cleaner.

The air cleaner has three spirals on its inner circumference through which the air and entrained moisture pass. The centrifugal action set up in the inner cleaner completes the cleaning of the air and also throws down any drops of water that have been picked up in the air. These water drops are thrown downward and back into the water container through the open end of tube *B*. This reduces the humidity of the washed air and also prevents excessive water consumption. The clean air, after passing out of the spirals in the inner cleaner, escapes upward and out through the elbow at the top of the carbureter air intake.

As long as there is any water in the container the whirling of the water keeps the end of tube *B* (which is very close to the bottom of the container) sufficiently open for the downwardly projected water to re-enter the reservoir. However, if the water supply is allowed to totally evaporate, enough mud and dirt will settle under the open end of *B* to seal it, so that even if the container runs dry, the inner air cleaner will collect the dust as a dry air cleaner. Of course, if the water container is dry and also clean, no such cleaning action is possible unless opening *B* is closed.

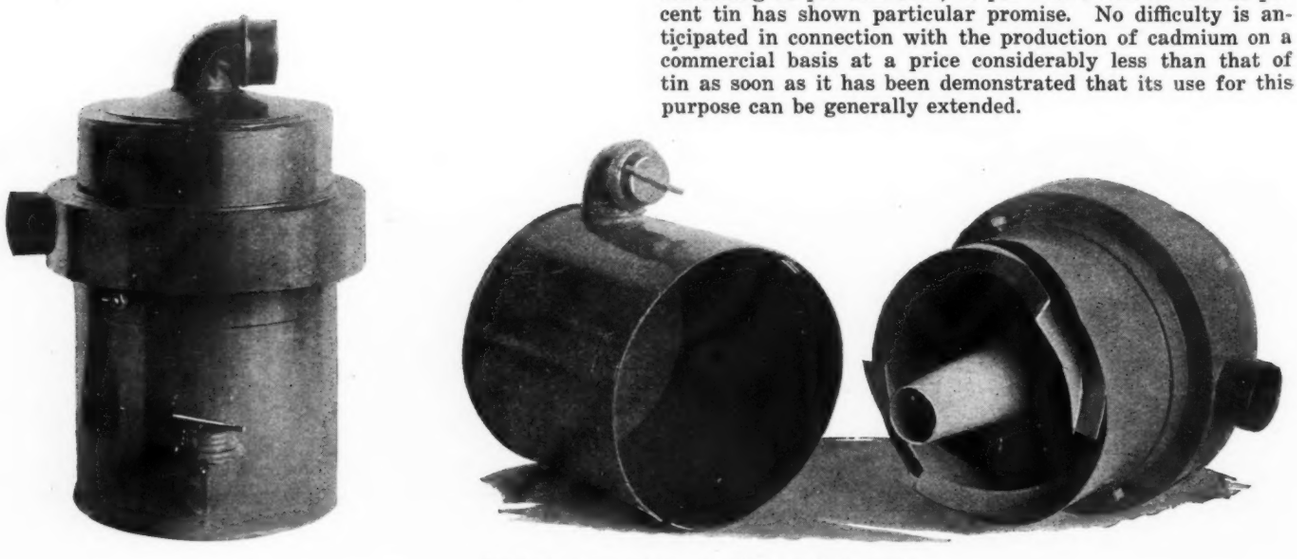
The water compartment is filled to the top of the filler cap.



Section through air washer

At normal summer temperatures one filling should last a full day with a tractor in the field.

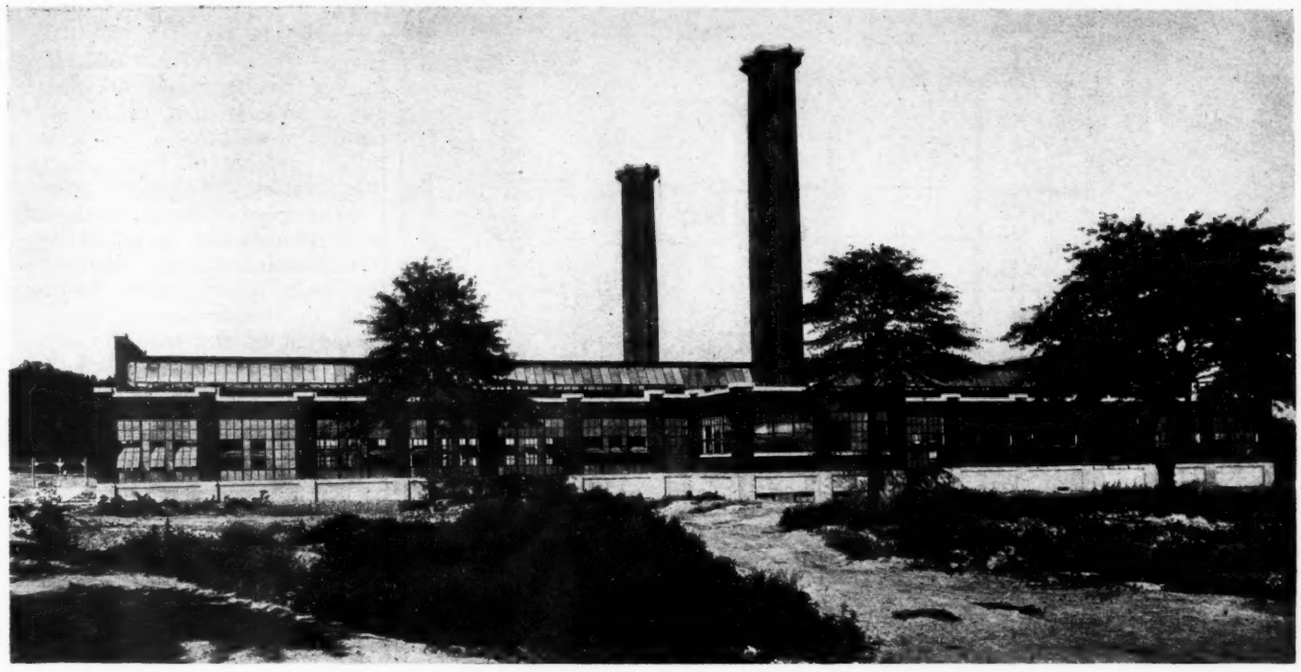
To clean the accumulated mud or dirt from the air washer, nuts *D* are loosened, the water reservoir is turned to free it from the catches on the studs, and is then removed and cleaned thoroughly and frequently. It is then replaced and refilled with water. The air washer when used where there is much dust, should be cleaned every day.



Bennett air washer complete and in parts

Cadmium as Substitute for Tin

THE possibility of using cadmium as a substitute for tin in solder appears promising. Among others the composition containing 80 per cent lead, 10 per cent cadmium and 10 per cent tin has shown particular promise. No difficulty is anticipated in connection with the production of cadmium on a commercial basis at a price considerably less than that of tin as soon as it has been demonstrated that its use for this purpose can be generally extended.



New engine test house of the Duesenberg Motors Corp.

A 900-Hp. Dynamometer Installation

New Test House of the Duesenberg Motors Corp. Has Several Features of Novelty Relating to Water Cooling, Exhaust Disposal and Dynamometer Tests of Mammoth Engines

AIRCRAFT engine testing confronts the engineer with problems which differ from those of automobile engine testing chiefly because of the enormous powers involved. While the 1000-hp. mark has not yet been reached in aircraft engines, its attainment is already in sight. The majority of the engines now being produced in this country for aircraft work range over 400 hp. on the brake, which is more than ten times as much as the average automobile engine. This comparison is here made because in the past standard testing equipment has been largely designed for automobile engine tests.

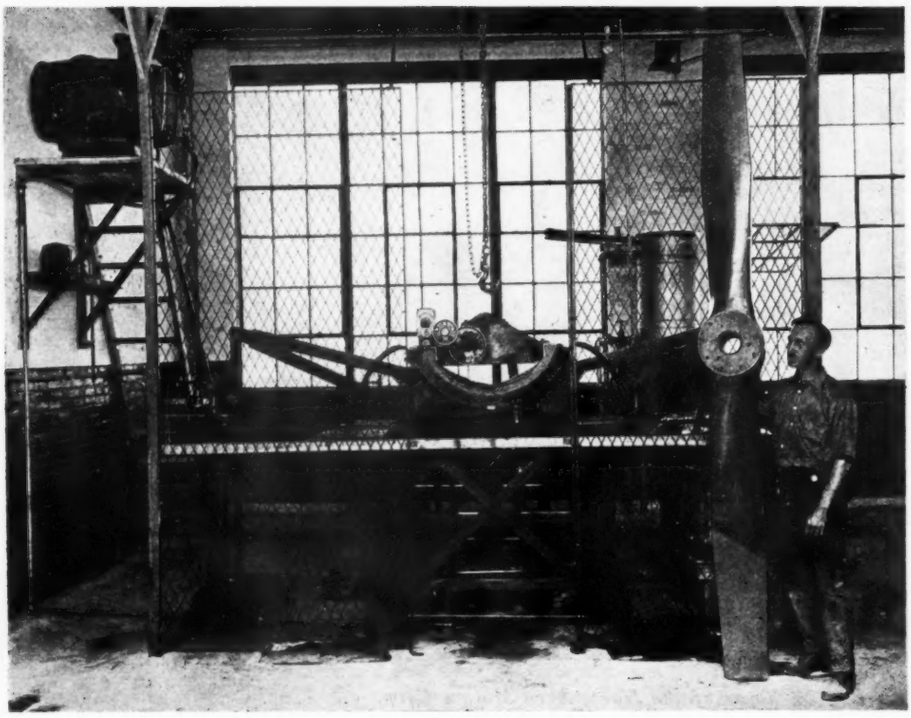
Obviously, engines for aircraft must be more rigidly tested than those for any other purpose, and the departments letting the contracts issue detailed specifications of the tests each engine must pass before it will be accepted. In addition to routine tests of its regular stock product, an engine factory carrying on development work must also conduct tests on experimental engines, and these latter call for somewhat different equipment than the routine tests.

In regular routine tests it is desirable that the conditions of actual use be duplicated as nearly as possible. Formerly it was customary to test aircraft engines with plain clubs which are really a form of fan dynamometer. By plain club is meant a beam of square or rectangular cross section which is secured to the engine crankshaft in the same manner as the propeller. Now, however, clubs with their ends given a form resembling propeller blades are used, to produce the identical condition of end thrust on the engine bearings to which they are subject in flying.

One of the most modern airplane engine testing departments in the country has just been completed by the Duesenberg Motors Corp. at Elizabeth, N. J. It is installed in a steel and brick structure on a concrete foundation, 240 ft. long by 67 ft. wide. A large part of the side walls is of glass, and efficient lighting and ventilation are further assured by a monitor roof construction.

As one enters the building, on the right there is an office where the test records will be kept, and directly behind it an oil storage and filter room. To the left of the entrance are a chemical laboratory (corner room) and a physical laboratory, where all material furnished the company for the manufacture of its engines may be analyzed and subjected to mechanical tests. In the physical laboratory, in addition to the usual testing machinery, are installed a number of light machine tools for machining up test specimens, and a furnace for heat treating them.

Passing through the entrance way between these two sets of rooms, one enters the main test room, which extends the whole width of the building and 176 ft. in length. This room is equipped with 22 test stands arranged in two rows, one along each wall. The test stands are of the cradle type, the power developed by the engines being determined by measuring, on a scale, the torque reaction of the dynamometer cradle. The cradle is supported by a heavy stub shaft at one end and in a semicircular guide at the other. Secured to the cradle



Showing one of the test cradles with its equipment and one of the large size clubs used for testing engines

are two arms which extend in opposite directions, and from the ends of these arms depend steel bars, of which one serves to transmit the pressure of the torque arm to the scale platform while the other merely balances the former. Mounted above each testing stand is a chain hoist. Engines are brought into the test room from the assembling department on industrial trucks, raised by the chain hoist and slid into position on the cradle of the test stand.

Each test stand is provided with its own fuel, oil and water supply and with an electric starter to start the engine. The gasoline tank is mounted high on the wall and feeds by gravity. It can be conveniently filled by means of a pump driven by a separate electric motor, mounted on the wall below the tank. Oil tanks are placed on the floor close to the stand and there is a water tank high up on the wall through which the cooling water is circulated by the pump on the engine.

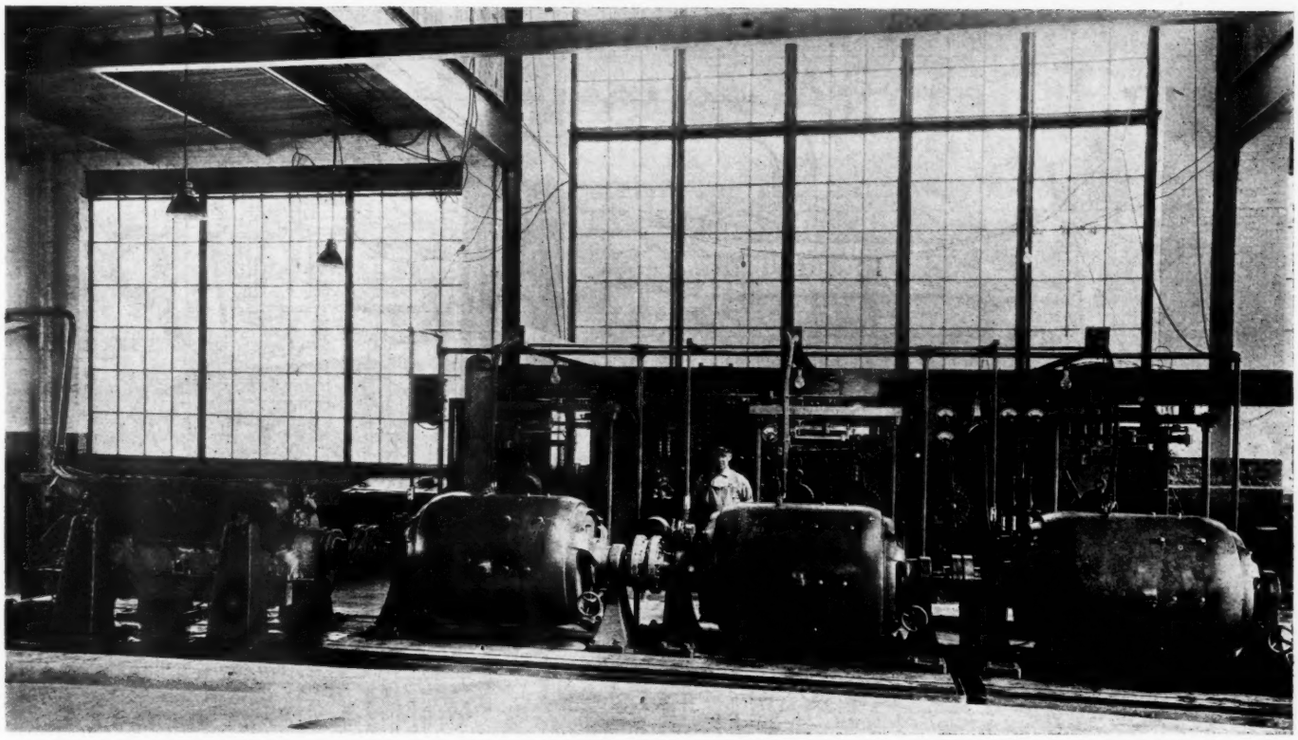
It can be readily imagined that a 400-500-hp. engine running under full load will quickly heat up an ordinary wall tank full of water, and a means of abstracting heat from the tank had to be provided. This problem was solved in an interesting way by the erection outside the building of a concrete cooling fountain, 50 ft. in diameter, of which a view is shown herewith. The whole cooling system has a capacity of 75,000 gal. A standpipe rises at the center of the fountain, through which the water is forced by a pump driven by an electric motor.

The top of the standpipe is surrounded by a mushroom-shaped plate, and as the water gushes from the pipe it is spread out in an even film. From this plate it drops onto successive annular surfaces of concrete, the film getting gradually thinner and the speed of the water slower as it spreads out, and from the last annular surface it returns to the basin below. Each cooling tank in the test room is connected in circuit with the electric motor pump and cooling fountain, and when the pump is running the water in, the cooling tank is being constantly renewed. The same water, of course, is used over and over, and a considerable economy is effected by this means.

In order to safeguard the men working around the engine under test, a heavy wire screen is placed between the engine and the propeller or club.

A problem of considerable importance is that of disposing of the exhaust products, for with 20 or more engines of several hundred horsepower each running under full load, it would take but a short while to vitiate the air to such an extent as to make it impossible for the testers to remain within the room. In the Duesenberg test room the exhaust gases from each engine are directed through an overhead funnel into a large underground duct which discharges into an 85-ft. stack. Natural draft is depended upon to suck all gases into the funnel and carry them through the underground duct and up the stack. There are two of the stacks, one for each row of test stands.

The cooling fountain serves the function of a giant radiator



View in the dynamometer room, showing three electric dynamometers coupled together

At the rear of the main test room is the dynamometer room, in which are installed three Sprague electric dynamometers capable of absorbing up to 300 hp. each. These machines are arranged tandem fashion and may have their shafts coupled together for tests of engines of over 300 hp. At each end of the set of dynamometers there is an engine stand, one of these stands being arranged chiefly for tests of very large engines requiring two or even all three of the dynamometers to be coupled together.

It was found that the shafts of the standard dynamometers were sufficiently rugged to permit of this method of connecting them up, but a special coupling had to be designed for the dynamometer closest to the engine. Electric tachometers are mounted on the dynamometers and in addition there is a Schaeffer & Budenberg tachometer driven by belt.

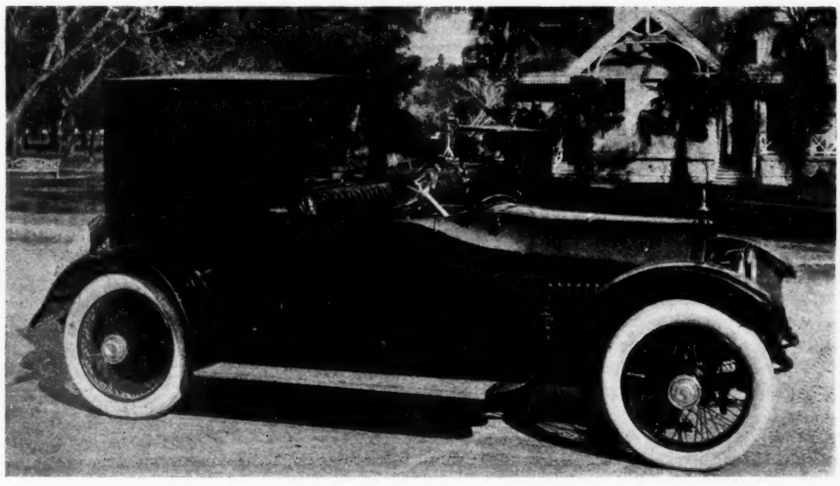
While the writer was at the plant there was a large engine on the dynamometer stand which was fitted with a compressed-air starter. However, provisions are also made for starting the engines under test electrically, through the dynamometers, running as motors. The current used for this purpose is taken from alternating current mains and is converted into direct current by a rotary converter installed in the dynamometer room.

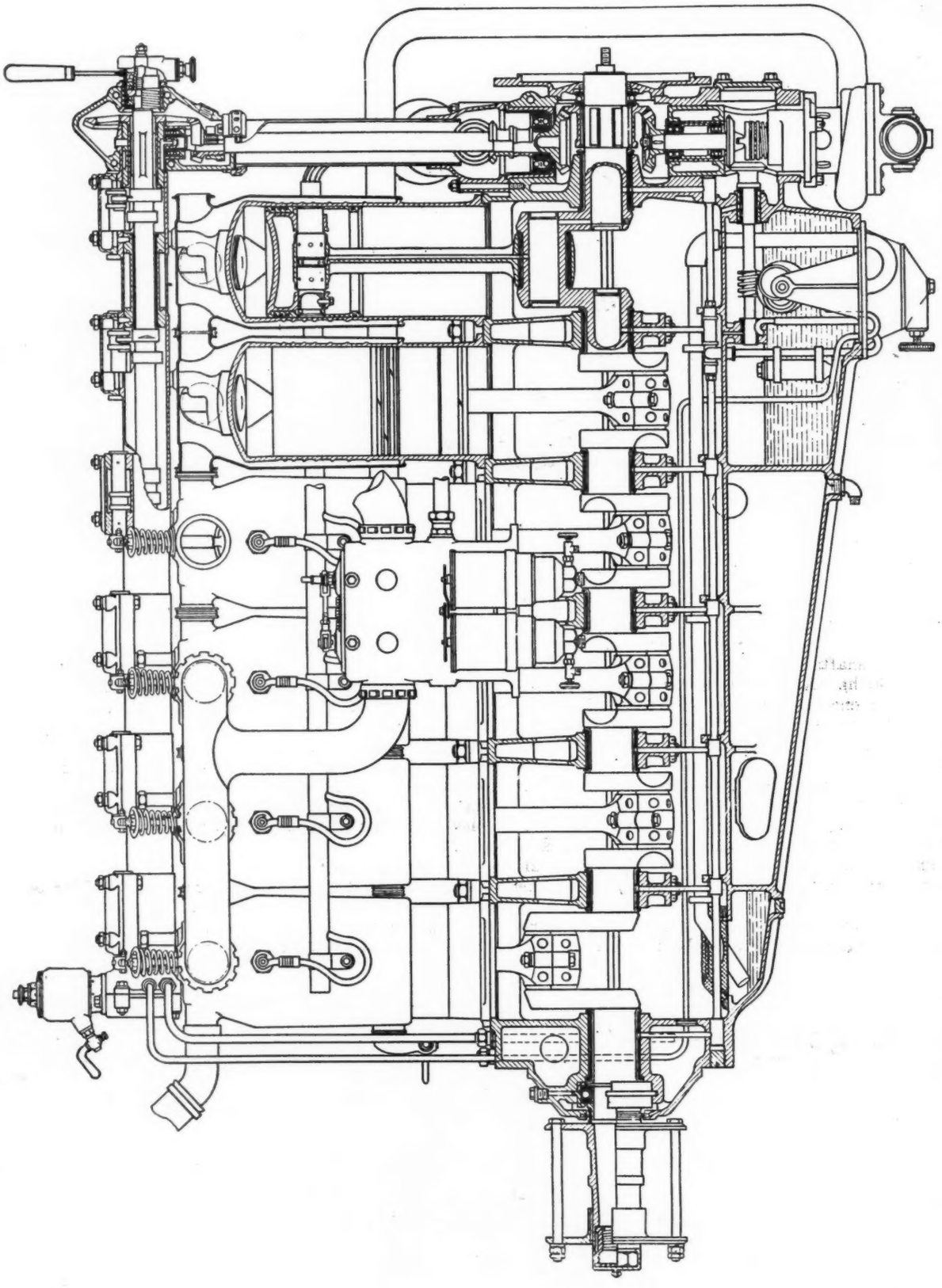
The energy developed by the dynamometers is absorbed in resistance grids located back of the switchboard on the rear wall of the building. These grids are in six sections and each is capable of absorbing 200 hp. An electric motor with a small propeller mounted on its shaft is supplied with current from the dynamometer and is used to blow a current of fresh air over the engine while under test.

The Duesenberg testing department is remarkable chiefly for the fact that it contains equipment for testing engines up to 900 hp. output, this being undoubtedly the most powerful dynamometer installation in any aircraft engine plant in the country at the present time.

An Argentine-Built Body

THIS photograph shows a car with a body built by Fehling Bros. of Buenos Aires, Argentine Republic. Fehling Bros. are importers of American chassis, and formerly had special bodies built to order in the United States; but they claim that the service was so poor that they were compelled to install their own body-building department, and this is one of the first bodies completed by them.





Elevation, partly in section, of the Mercedes 180-hp. aircraft engine of 140 mm. bore and 160 mm. stroke

The 180-Hp. Mercedes Aircraft Engine

A Development of the 160-Hp. Model, Having the Same Cylinder Dimensions—Compression Increased and Many Details Redesigned —Fuel Test Results and Table of Data

ENGINEERS of the Daimler Motor Co. have redesigned the 160-hp. six-cylinder Mercedes aircraft engine and have succeeded in raising its output to 180 hp. The following report, issued by the Technical Department (Aircraft Production) of the British Ministry of Munitions, is based on an examination of engine No. 35254 taken from the captured German Albatross biplane D.5.A. (G.97), which was shot down by anti-aircraft fire in the 5th Brigade area on Nov. 14, 1917, and the accompanying data on the design of the engine and the particulars of its general performance, have been compiled from results of tests carried out at the Royal Aircraft Factory.

The 180-hp. Mercedes engine is the first engine of a new type to be used in service since the advent of the 260-hp. Mercedes engines in the early part of last year. These 260-hp. engines were apparently so successful that the 160-hp. type have since been remodeled so as to introduce several of the leading features of the 260-hp. practice. The result is seen in the 180-hp. model, with which this report deals.

Comparison Between Old and New Designs

It necessarily follows from the above that this report will partake more or less of the character of a comparison between the 160-hp. and 180-hp. models. Frequent reference, therefore, is made in the text to the 160-hp. engine.

In many respects the design of this new engine is similar to the 160-hp. Mercedes, which is now obsolescent. The cylinders are of the same construction and of the same bore and stroke as the 160-hp., *i. e.*, 140 mm. x 160 mm., as also are most of the reciprocating parts; in fact, this engine might well be termed "The New 160-hp. Mercedes."

Briefly described, the 180-hp. Mercedes is a combination of the 160-hp. and the new 260-hp. Mercedes engines, and in view of this fact it will be unnecessary in this report to deal at length with the details of the design of those parts which are identical with the components of the above-mentioned engines, of which fully detailed reports have already been issued, and the design of which is now well known in this country.

In comparison with the standard type 160-hp. Mercedes, the new engine shows a marked improvement, both in the design as a whole and in its general performance during power and consumption tests, and as a comparison between the two engines the following comparative table of the leading particulars of the engines is herewith given:

	160 hp.	180 hp.
Bore	140 mm.	140 mm.
Stroke	160 mm.	160 mm.
Compression ratio	4.50:1	4.64:1
Average b.hp. and speed	162.5 at 1400	174 at 1400
B.M.E.P. (lb. per sq. in.)	102.0 at 1400	109.1 at 1400
*Total weight of engine (dry)	618 lb.	635 lb.
Weight per b.hp.	3.80 lb.	3.65 lb.
Fuel consumption per hour	94.2 pints	94.83 pints
Fuel consumption per b.hp. hr.	.58 pint	.545 pint
Oil consumption per hr.	5.0 pints	7.3 pints
Oil consumption per b.hp. hr.	.031 pint	.042 pint
Inlet valve opens	2° L.	T.D.C.
Inlet valve closes	35° L.	40° L.
Exhaust valve opens	63° E.	40° E.
Exhaust valve closes	13° L.	10° L.
Ignition timing (fully advanced)	30° E.	30° E.
Delivery of water pump		41.4 gals. per min.

*This weight is weight of engine (dry), excluding propeller hub and exhaust manifold.

The six separate cylinders are exactly the same construction as those used in the standard 160 hp. Mercedes engines, being built up entirely of steel, with the valve pockets threaded and welded into the cylinder heads, and the water jackets of pressed sheet steel welded in position. The pistons also follow the standard Mercedes practice and are similar to those used in the 160 hp. engines, being constructed with concave heads machined from steel forgings, which are screwed into the cast-iron skirts of the pistons and welded in position.

Three rings are provided above the piston pins and one ring below, which is situated at the base of the skirt. The piston pins are carried in lugs machined in the lower part of the steel piston crown. The compression ratio, it will be noticed, is slightly higher in the new 180-hp. engines, being 4.6:1 as compared with 4.5:1.

The H section connecting-rods with their floating cast iron piston pin bushes also follow the usual Mercedes practice, and are identically the same as those used on the 160-hp. engines, and the whole of the camshaft vertical driving shaft and also the water and oil pumps driving gear is similar to the 260-hp. engines.

No alteration has been made in the general design of the crankshaft from the standard 160-hp. type. The leading dimensions, clearances and method of lubrication of the journal and connecting-rod bearings are the same, as shown in the general sectional view of the engine.

The crankcase while following the general construction of the 160-hp. engines, also resembles in many ways the 260-hp. type. The usual Mercedes practice of casting the lower half of the main bearing housings integral with the bottom half of the base chamber, and also the method of holding down the cylinder by long bolts which pass through the base chamber top half and secure the halves of the crankchamber, is adhered to.

Valve Gear New

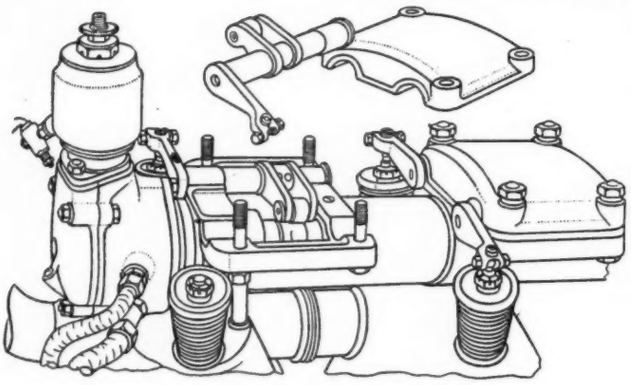
The single inlet and exhaust valve of each cylinder, which work at an angle of 15 deg. to the axis of the cylinder, are interchangeable as in the 160-hp. engines and are of similar design. The valve operating gear is, however, of new design and follows more the construction of the valve gear on the 260-hp. Mercedes engines. General details of this construction and working of the valve gear are shown in the sketch.

It will be noticed that the rocker arms and their spindles are now integral, being machined from steel forgings. The camshaft casing is constructed entirely from malleable-iron castings, and the valve rocker spindles work in direct contact with the malleable iron, no bronze bushes being provided as bearings for the rocker arm spindles, and the covers of the camshaft casing form the top portion of the rocker spindle bearings.

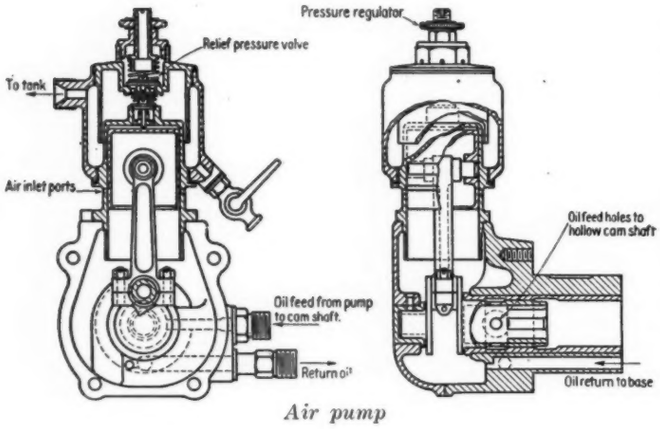
The rocker spindles are hollow, and are lubricated through two holes drilled radially in the spindles by oil thrown off the revolving cams into the two holes drilled in the rocker arm carrying the cam roller.

This design of valve gear is undoubtedly a great improvement on the arrangement adopted in the 160-hp. Mercedes, the construction of which is well known, having the rocker arms working through slots in the camshaft casing, which are provided with felt-packing strips and baffle plates for retaining the oil in the camshaft casing.

The camshaft is of similar design to the 160-hp. Mercedes, and the casing is supported on long studs which are screwed into the head of each cylinder.



Valve gear and air pump



Air pump

With regard to the valve timing, this, it will will be noticed, is different from the standard 160-hp. Mercedes, as shown in the comparative list of leading particulars. The valve lift has been increased from 0.440 in. on the 160-hp. engines to 0.452 in. Only very minor differences occur in the actual dimensional details of the half compression gear in the new engine. Details of this mechanism are now well known; the general design is, however, clearly shown in the general arrangement sectional drawing of the engine.

Carbureters

No alteration has been made in the design of the twin-jet dual carbureters. Both carbureters are enclosed in a cast aluminum water jacket, which is coupled at the bottom by a water pipe to the delivery pipe of the water pump at the top of the water jacket of the rear cylinder to the top portion of the water jacket of the carbureters.

Each carbureter feeds three cylinders by a branched induction pipe of steel tube which is lagged with asbestos cord and bound with adhesive tape. The throttles are, of course, interconnected, and are operated by a cable and also by a control lever and rod. The float chambers are of ordinary design, but are fitted with separate filters attached to the bottom of each float chamber, which are easily detachable. These filters are provided with needle-valve drain cocks. No compensation arrangement is provided for altitude control. The bore of the main jets is 1473 mm., and the bore of the pilot jets .558 mm., which is the same as in the 160-hp. Mercedes carbureters. A semi-diagrammatic sectional view of one of these carbureters is reproduced for reference.

The air-intake to the carbureters is taken through the passage cast in the central portion of the top and bottom halves of the base-chamber, which forms an air chamber between the front and rear oil pumps in the lower portion of the bottom half of the base. Air enters the central air chamber through two holes cast in the sides of the chamber and also warm air through a large diameter pipe leading from the central portion of the top half of the crank chamber.

Camshaft Drive

The method of fixing the camshaft driving bevel at the top end of the vertical shaft, as shown in the sketch, is unusual. This method is similar to that adopted in the 260-hp. engines, and is so designed as to allow of a certain amount of vertical adjustment of the bevels. The driving end of the vertical shaft is machined and ground parallel, 21 mm. diameter, and is fitted with a key, which fits in a keyway in the driving bevel; a ground taper on the bottom extension of the bevel, which is split by four saw cuts, and into which screws a ring nut, locks the bevel securely in position on the vertical driving shaft.

In the old 160-hp. Mercedes engines the camshaft driving bevel on the vertical shaft is fixed by two bolts in the split extension of the bevel which is fitted on to a ground taper on the vertical shaft.

Referring to the sketch of the vertical shaft, it will be seen that the bottom end of the shaft is carried on a "Skefko" universal bearing, which is mounted inside a steel sleeve, carried at the rear end of the crankcase, and is driven off the floating bevel gear on the rear end of the crankshaft in the usual way.

Lubrication

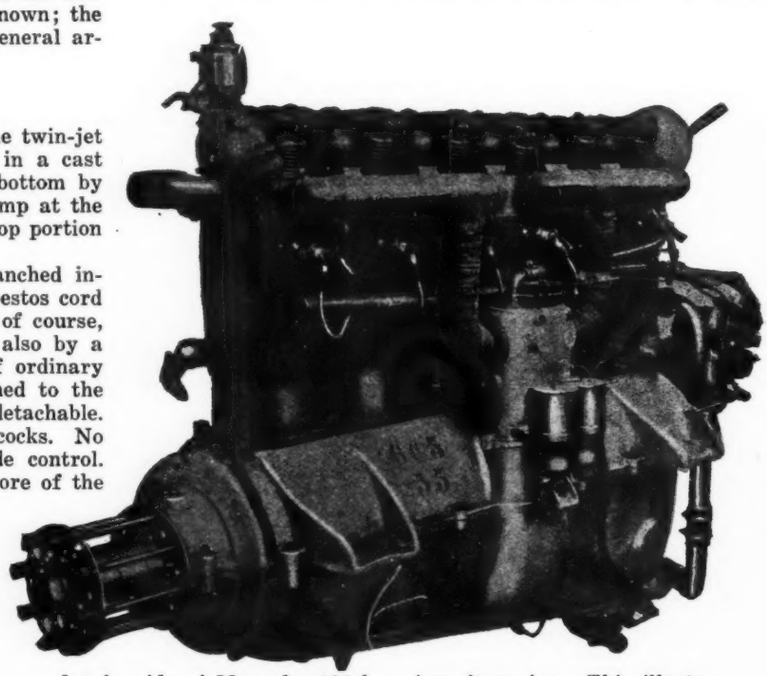
The old 160-hp. type multiple-plunger oil pump has been replaced by the larger pump, similar in design to the 260-hp. Mercedes pump. The oil pump is attached to the bottom of the rear oil sump or reservoir, at the rear end of the base chamber.

The functions of the oil pump are perhaps most clearly demonstrated in the diagrammatic sectional drawing and in the sectional sketch of the pump.

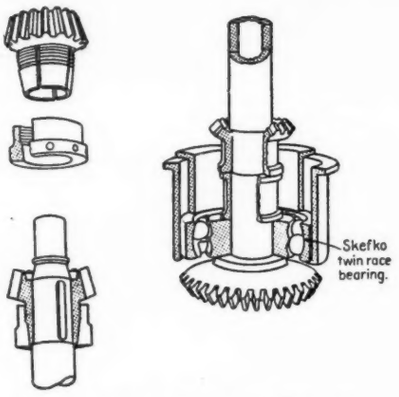
Briefly described, the functions of the oil pump and the system of lubrication may be sub-divided into three circuits.

(*a*) *The main pressure circuit*, in which oil is drawn from the main oil sump at the rear of the base chamber and is forced to the main crankshaft journal-bearings and connecting rod bearings, and also the camshaft bearings.

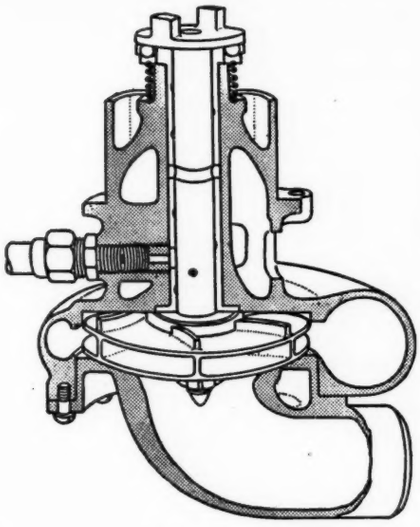
(*b*) *The supplementary pressure system*, which works in conjunction with the main high-pressure system, in which two auxiliary plungers of the main oil pump draw a small charge of fresh oil from the service oil-tank at every stroke of the



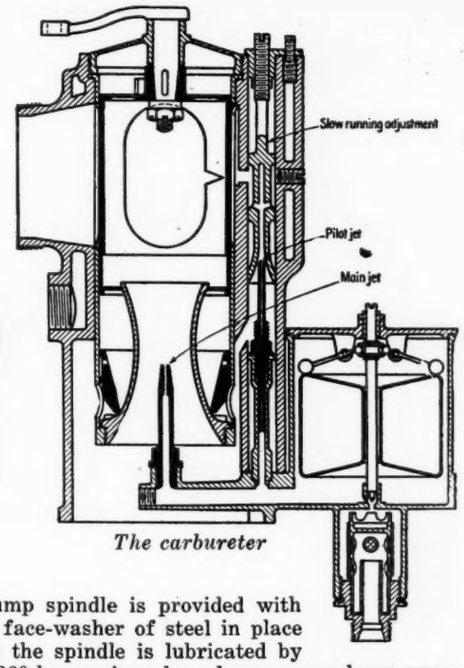
Intake side of Mercedes 180-hp. aircraft engine. This illustration clearly shows the method of supporting the carbureter on the crankcase and drawing the air through the latter in order to heat it



Camshaft driving pinion attachment and arrangement of ball bearing at bottom end



Water pump



The carbureter

pump and force the charge into the main circulation system.

(*c*) *The suction or scavenger circuit,* which supplies the main oil sump from the auxiliary drain sump at the front end of the base chamber, the working oil level being maintained in the rear sump by an auxiliary suction pump which draws off the oil above the oil level through an overflow pipe and returns it to the oil tank.

An oil sight level indicator is provided in the side of the rear oil sump.

Full details of the functions and operation of this somewhat complicated oil pump are given in the previous report on the 260-hp. Mercedes engine.

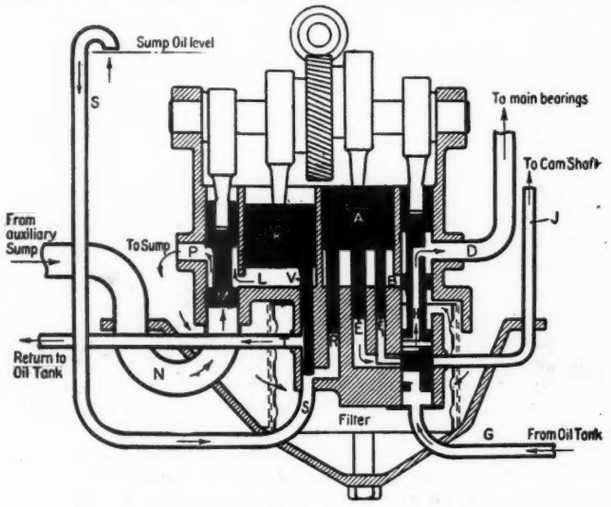
Ignition

Two Z.L.6 type Bosch magnetos are fitted at the rear end of the engine and are driven directly off the camshaft vertical driving shaft by bevel gears, as in the 260-hp. engines.

Ignition is by two Bosch 3-point plugs fitted to each cylinder, one on either side of the cylinder below each valve head, and the h.t. cables are carried as usual in fiber tubes attached to the cylinders.

The ignition timing is fixed at the same period as in the 160-hp. engines, *i.e.*, 30 deg. E., and the speed of the magnetos is 1.5 times engine speed. Firing order: 1, 5, 3, 6, 2, 4.

The water pump in the old type 160-hp. Mercedes engines is situated above the magneto drive, and is driven directly off the vertical camshaft driving shaft. In the 180-hp. engine the standard 260-hp. type water pump has been adopted. This is now driven, as in the large engines, by a dog clutch off the bottom end of the lower vertical shaft, which also drives the oil pump worm driving shaft, as shown in the sectional view.



Diagrammatic section of oil pump

The water pump spindle is provided with a spring-loaded face-washer of steel in place of a gland, and the spindle is lubricated by hand, as in the 260-hp. engines, by a large screw-down grease lubricator accessibly arranged on the pilot's seat. Details of this water pump are clearly shown in the sketch.

This is of a new design, and is now driven off the front end of the camshaft, as in the 260-hp. engines. The piston and barrel of the air pump are made of cast iron, and the piston is operated by a small connection rod of bronze and a double webbed crank, as shown in the sectional sketch. The air pump crankshaft is provided with four serrations which fit into the corresponding splines cut on the inside of the hollow camshaft. The bore of the pump is 40 mm., and the stroke is 40 mm.

Air inlet ports are drilled in the lower portion of the pump barrel and are uncovered by the piston at the bottom of its stroke, and the delivery check valve is situated in the head of the pump barrel. A regulating valve is provided directly above the check-valve, the released air escaping through the center of the hollow adjusting screw, and also through six small holes drilled radially in the threaded cap which forms the seating of the regulating valve.

A self-contained oil trap is provided by the gun-metal jacket which surrounds the barrel of the air pump. This is fitted with a drain cock, as shown in the sketch. The air pump piston and crankshaft are lubricated by the excess oil in the camshaft casing.

Details of Oiling System

The main oil lead from the oil pump to the hollow camshaft is taken through a passage drilled in the crank-chamber of the air pump, the oil entering the camshaft through four 5 mm. holes drilled radially in the hollow air pump crankshaft, which register with a groove cut in the inside of its bearing.

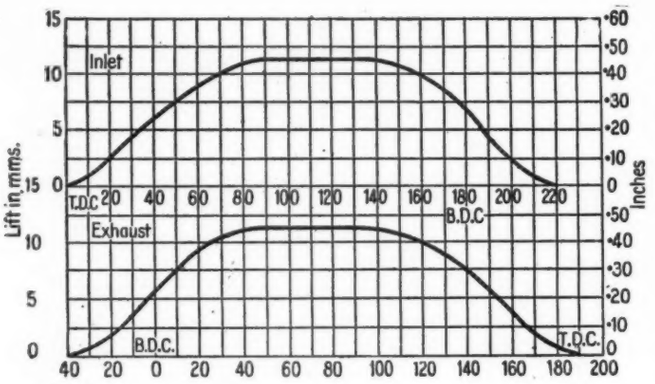
The following is a summary of a report of the 180-hp. Mercedes engine carried out at the Royal Aircraft Factory, Feb. 6, 1918:

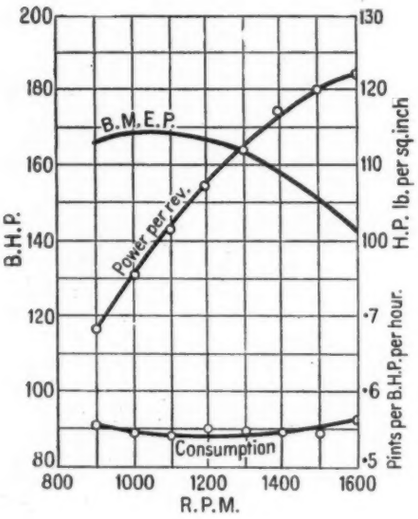
The engine was erected on test bed, and coupled to a Heenan and Froude dynamotor, and power readings taken at various speeds, simultaneous fuel and oil consumption readings being taken. The results of these tests are shown graphically on the curves attached to this report.

These curves show the following readings:

R.p.m.	1300	1500
B.h.p.	165	180
B.m.e.p.	112	105.5
Fuel consumption in pints per b.h.p. hour	.540	.555
Normal engine speed	1,400 r.p.m.	
Average b.h.p.	174	
Average petrol consumption	.545 pint per b.h.p. hr.	
Average oil consumption	.042 pint per b.h.p. hr.	

During a previous test the engine was run up to 1700





Above—Valve lift diagram. Left—Power, brake mean effective pressure and fuel consumption curves

r.p.m., at which speed 197.5 b.h.p. was recorded, but at this speed the engine was found to be incapable of giving constant power.

The engine was run at 1400 r.p.m. for the purpose of calibrating the output of the water pump, which delivered into a graduated tank at the rate of 41.4 gal. per min.

Owing to the fact that during the above test it was found to be impossible to tune up the engine, the power developed does not probably represent its best performance, as from other data and tests of the engine a normal b.h.p. of 179.5 at 1400 r.p.m. and a maximum b.h.p. of 188 at 1500 r.p.m. has been recorded.

Further details of the 180-hp. engine are given in the accompanying list of particulars.

Weights	Lb.
Weight of engine complete, dry, including propeller hub and exhaust manifold	660.0
Weight per b.h.p.	3.79
Weight of exhaust manifold	13.0
Weight of oil carried in engine	19.125
Weight of fuel and oil per hour	93.53
Gross weight of engine in running order, less fuel, oil and tanks, but including cooling system, at 0.64 lb. per b.h.p.	773.0
Weight per b.h.p.	4.44
Gross weight of engine in running order, with fuel, oil and tanks for six hours. (Tanks at 10 per cent weight of fuel and oil)	1,390.8
Weight per b.h.p.	8.00

Engine Data

Number and arrangement of cylinders	Six vertical, separate.
Bore	140 mm. =5.51 ins.
Stroke	160 mm. =6.30 ins.
Stroke-bore ratio	1.142:1.
Area of one piston	23.84 sq. ins. =153.9 sq. c
Total piston area of engine	143.04 sq. ins. =924 sq. c.
Stroke volume of one cylinder	150.28 cu. ins. =2,463 c.c.
Total stroke volume of engine	901.68 cu. ins. =14,778 c.c.
Volume of clearance space	41.3 cu. ins. =676.64 c.c.
Compression ratio. Total volume-clearance volume	4.64:1.
Normal b.h.p and speed	174 b.h.p. at 1,400 r.p.m.
Piston speed	1,470 ft. per min.
Brake mean pressure	109.1 lbs. sq. in.
Cu. ins. of stroke volume per b.h.p.	5.18 cu. ins.
Sq. in. of piston area per b.h.p.	0.823 sq. in.
B.h.p. per cu. ft. of stroke volume	334.0.
B.h.p per sq. ft. of piston area	175.0.
Direction of rotation of crank and propeller	Anti-clockwise facing propeller.
Lubrication system	Forced, multiple plunger pump.
Oil consumption per hour	7.3 pints =8.21 lbs.
Oil consumption per b.h.p. hour	0.642 pint =0.047 lb.
Oil pressure	20 lbs. sq. in.
Volume of oil carried in base-chamber	17 pints.
Number and type of carbureter	One dual Mercedes, twin-jet.
Diameter of chokes	0.945 in. =24 mm.
Bore of main jets	0.058 in. =1.472 mm.
Bore of pilot jets	0.022 in. =0.559 mm.
Fuel consumption per hour	94.83 pints =85.32 lbs.
Fuel consumption per b.h.p hour	0.545 pint =0.491 lb.
Inside diameter of induction pipes	2.126 ins. =54 mm.
Number and type of magnetos	Two, Bosch, Z.L.6.
Firing sequence of engine	1, 5, 3, 6, 2, 4.
Ignition timing (fully advanced)	30° early.
Speed of magnetos	1.5 engine speed.
Inlet valve opens	Top dead center.
Inlet valve closes	40° late.
Diameter of inlet valve (smallest diam.) $= d$	2.677 ins. =68 mm.
Lift of inlet valve $= h$	0.453 in. =11.5 mm.
Area of inlet valve opening(w.d h.)	3.81 sq. ins. =24.58 sq. c.
Mean gas velocity through inlet valve	153.4 ft. per sec.
Clearance of inlet tappet	0.017 in. =0.432 mm.
Exhaust valve opens	40° early.
Exhaust valve closes	10° late.
Diameter of exhaust valve(smallest diam.) $= d$	2.677 in. =68 mm.
Lift of exhaust valve $= h$	0.453 in. =11.5 mm.
Area of exhaust valve opening $(\pi d.h.)$	3.81 sq. ins. =24.58 sq. c.
Clearance of exhaust tappet	0 014 in. =0.355 mm.
Diameter of inlet and exhaust ports	2.165 ins. =55 mm.
Diameter of water pump inlet	1.692 ins. =43 mm.
Diameter of water pump outlet	1.575 ins. =40 mm.
Ratio of water pump speed to crankshaft speed	1.5:1.
Delivery of water pump at normal speed	41.4 gals. per min.
Inlet water temperature	64° Cent.
Outlet water temperature	74° Cent.
Water jacket capacity of one cylinder	1,280 c.c.

Description of Part	No. per set	Average unit weight	Weight of complete set	Percentage of total weight
Cylinders (bare)	6	19.25	115.50	17.5
Pistons, complete with rings and gudgeon pins	6	6.85	41.10	6.23
Connecting rods, with gudgeon pin bushes	6	5.00	30.00	4.55
Valves, complete with springs, etc	12	1.31	15.74	2.39
Crankshaft (bare)	1	70.00	70 00	10 60
Camshaft (bare)	1	7.75	7.75	1.17
Camshaft casing with bearings and covers	1	27.63	27.63	4.18
Valve rockers	12	.87	10.50	1.59
Half compression gear (complete)	1	7.00	7.00	1.06
Vertical driving shaft (complete), including casing, oil pump, drive, and floating bevel	1	17.50	17.50	2.66
Base chambers (top half)	1	72.25	57 22	10 92
Base chamber (bottom half)	1	100.00	100.00	15 16
Carbureters	one dual	16.75	16.75	2.54
Induction pipes (lagged asbestos)	2	5.00	10.00	1.52
Water pump (complete)	1	7.75	7.75	1.17
Oil pump (complete)	1	13.25	13 25	2.00
Air pump (complete)	1	4.75	4.75	.72
Magnetos (complete)	2	14.00	28 00	4.25
Water piping	—	3.25	3.25	.49
Propeller hub (complete)	1	12.50	12.50	1.90
Ignition wiring (complete)	2	2.00	4.00	.61
Exhaust manifold	1	13.00	13.00	1.97
Miscellaneous parts	—	31.78	31.78	4.82
Total weight of complete engine (dry) (with propeller hub and exhaust manifold)	660 lbs.			100.00

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AN item in a recent issue of U. S. Commerce Reports deals with the subject of the manufacture of alcohol from the sotol plant. This plant grows in Mexico, and its supply is practically unlimited. It is stated that so far only about 100 bbl. of alcohol has been manufactured from the plant. That the manufacture has not been pushed to a larger scale is due partly to difficulty in securing competent distillery men and partly to the fact that the sap of the sotol plant has not the proper chemical properties from about June 1 to Aug. 15. Arrangements are reported to have been made to secure a good distillery man and to begin work about Aug. 15, with the expectation of having the plant operate at full capacity from that time on.

A New Method of Obtaining Brinell Hardness*

An Impact Substituted for a Steady Pressure to Reduce the Time Required for Applying the Test — Method Consistently Accurate

By J. G. Ayers, Jr.

THE present types of Brinell machines generally follow the original Brinell principle of forcing a ball of standard diameter into the steel under test by means of a standard load hydraulically applied. Several seconds are required to bring the full load to bear upon the ball and test specimen, and several more are used in maintaining this pressure, according to approved practice.

Under laboratory conditions, where time is not so important a factor as accuracy, the present types of machines are entirely satisfactory. There are cases, however, where testing must be done on a large commercial scale, as in the acceptance of raw material, and where the hardness range permissible does not require tests of laboratory accuracy. In such cases the rapid and approximate determination of the hardness of thousands of pieces is more important and productive of better results than the extremely accurate testing of a limited number whose hardness, unfortunately, is not always representative of the lot as a whole.

With the idea of overcoming this objection and of making possibly a simpler machine which, while not possessing the accuracy of the ordinary Brinell machine, would be capable of giving results that would be satisfactory for tests on a commercial scale, the writer has conducted experiments which have led to results far more encouraging than he had hoped. While the final form of the machine, including the necessary mechanical details, has not yet been developed, a description of the principle involved and the results obtained in the various experimental tests may prove of interest.

Instead of applying a standard dead load as in the ordinary Brinell machine, a given or standard impact was used. It is of course impossible to choose a standard impact that will produce the equivalent Brinell impression in a steel of any hardness, but for a given Brinell hardness it is possible to determine empirically the impact required to produce an impression identical with the one produced by the standard Brinell machine. It was decided to choose that impact which gives a 3-mm. diameter impression in a steel of 418 Brinell hardness. This impact would therefore give the same result on a steel of this hardness as the standard Brinell machine using a 10-mm. ball and a 3000-kg. load. A cylindrical 10-kg. weight with a cone-shaped lower end was used, in which the standard 10-mm. ball was fastened securely. See Fig. 1. The proper height from which the weight should fall to produce a 3-mm. diameter impression was determined experimentally by raising it to various heights by means of a supporting wire and hand crank and then severing the wire. This height was found to be 70 mm., and the impact would therefore be 0.700 m-kg. Using this impact as a standard, specimens of various Brinell hardness were tested by this device and the diameters of the impressions obtained were plotted as ordinates against the standard Brinell machine hardness numbers as abscissas. Fig. 2 shows the results obtained.

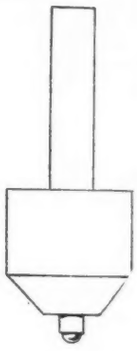


Fig. 1—Cylindrical weight and 10 mm. ball

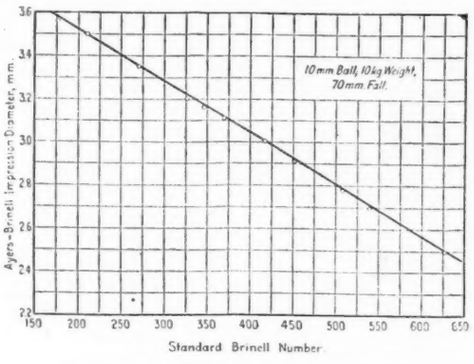


Fig. 2—Ayers-Brinell diameters plotted against standard Brinell hardness

Table I—Brinell Hardness Numbers for "Ayers-Brinell" Machine
10-mm. Ball; 10-kg. Weight

Diameter of Ball Impression, Mm.	Hardness Numbers		Diameter of Ball Impression, Mm.	Hardness Numbers		Diameter of Ball Impression, Mm.	Hardness Numbers		Diameter of Ball Impression, Mm.	Hardness Numbers	
	36-mm. Fall	70-mm. Fall		36-mm. Fall	70-mm. Fall		36-mm. Fall	70-mm. Fall		36-mm. Fall	70-mm. Fall
2.00	629	838	2.50	419	628	3.00	209	418	3.50	....	208
2.05	608	817	2.55	398	607	3.05	188	397	3.50	....	187
2.10	587	796	2.60	377	586	3.10	167	376	3.60	....	166
2.15	566	775	2.65	356	565	3.15	146	355	3.65	....	145
2.20	545	754	2.70	335	544	3.20	125	334	3.70	....	124
2.25	524	733	2.75	314	523	3.25	104	313	3.75	....	103
2.30	503	712	2.80	293	502	3.30	83	292	3.80	....	82
2.35	482	691	2.85	272	481	3.35	62	271	3.85	....	61
2.40	461	670	2.90	251	460	3.40	41	250	3.90	....	40
2.45	440	649	2.95	230	439	3.45	20	229	3.95	....	19

As it is sometimes advisable to use a lighter load than 3000 kg. with the standard Brinell machine, it was decided also to try the effect of a lesser impact. Instead of taking one-half the standard impact of 0.700 m-kg., that height of fall was determined which would give a 3-mm. diameter impression in a steel of 209 Brinell hardness using the same 10-kg. weight and 10-mm. ball. In other words, the new device would give the same result on a steel of this hardness as the standard Brinell machine using a 10-mm. ball and 1500-kg. load. This height was found to be 36 mm., giving an impact of 0.360 m-kg.

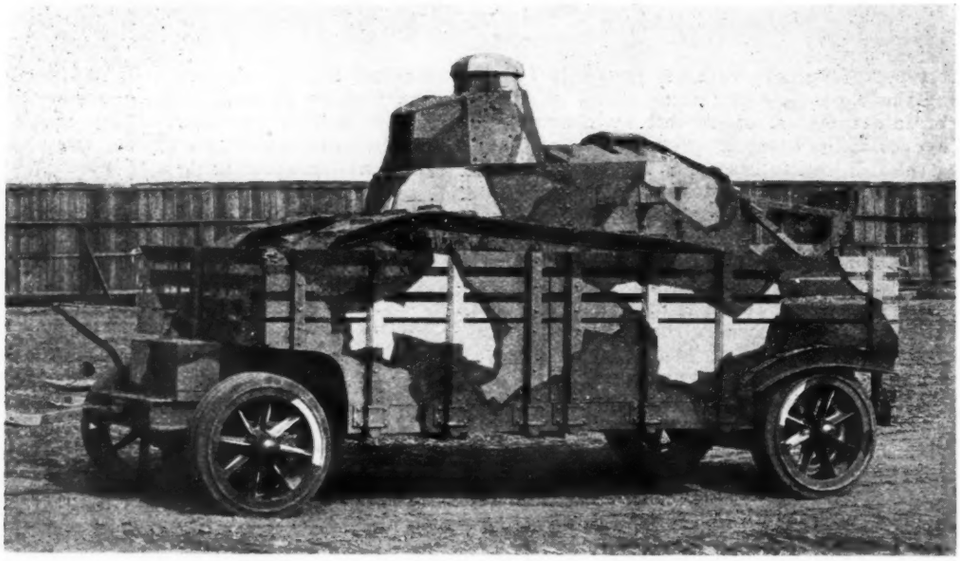
In Fig. 2 the hardness-impression curve is practically a straight line and the points experimentally determined fall as closely to this line as could be desired, considering that in no case does their deviation from the line amount to a greater distance than that corresponding to the error involved in the microscopical determination of the diameter of the impression. Repeated tests gave excellent checks in all cases and showed that this method is consistently accurate and free from erratic tendencies. Each determination can be read directly in standard Brinell numbers by the use of Table I, the data for which has been obtained from Fig. 2.

(*Continued on page* 481)

*Paper presented to the American Society for Testing Materials at its annual meeting at Atlantic City, June 25-28, 1918.

Grant Company Making Three Ordnance Trailers

Types Adapted for Use as Cargo Carriers, Gun Platforms and Shops—Incorporate Standard Features Where Possible



Ten-ton trailer loaded with a small French tank

THE line of trailers manufactured for the Ordnance Department by the Grant Motor Car Co., Cleveland, clearly illustrates the great variety of uses to which trailer equipment can be put in warfare. There are three of these trailers, one for moving 3-in. field guns and which is also adaptable to the French 75, or the equivalent English field piece; another, a 4-ton trailer upon which may be mounted a shop body, a cargo carrying body or a variety of other bodies, and the third a trailer for anti-aircraft guns which forms a platform for the gun and upon which the gun is mounted permanently.

The 3-in. field gun trailer has a capacity of 9000 lb. It has a wheelbase of 120 in. and a track width of 77½ in. By its use the mobility of the U. S. 3-in. field piece, or the French and British equivalent, is greatly increased, since this trailer with the gun can be towed behind a tractor or truck at a much higher speed than would otherwise be possible.

The trailer is a four-wheel type having a single-end steer, the steering being accomplished through the drawbar by means of a flexible connection with the steering lever, which is in turn connected to the steering cross-arm. The trailer is built on a pressed steel frame, mounted on semi-elliptic springs on the I-beam front axle and the rectangular dead rear axle. The floor is of oak planks carried on wood bolsters with mountings to support it at the required height above the frame cross members. An inverted panel is provided along the center of the floor and there are four recesses to leave clearance for the gun trail. To provide for the different guns to which this trailer can be adapted, there are three special pintles which can be mounted at the desired points along the platform.

The front axle is an I-beam section to which is bracketed a central supporting member to carry the steering lever. Pivoted to the steering lever on the center line of the trailer are the two steering cross-arms. These connect in turn with the steering knuckles and are laid out so that the trailer will track accurately behind the tractor which tows it. The front wheels are roller bearing mounted.

The rear axle is a rectangular section forging, carrying the rear axle spindle as an integral unit. Roller bearings are fitted to these spindles to support the load of the rear wheels. The rear axle is a dead member and is dropped just inside the spindle, allowing the semi-elliptic springs to be overslung. The rear wheels carry the brake drums in which operate the internal expanding brake shoes, which are controlled by a hand lever at the front end of the trailer. The brake drums are 19 in. in diameter and the shoes are faced with asbestos fabric. Brake action is controlled by a straight pull rod from the hand lever at the front end of the trailer. There is a ratchet on this lever which allows the brake to be locked on in case it is desired.

The drawbar has a double coil spring housed within it, which takes up the towing shock in either direction. The drawbar is 42 in. in length and connects with the steering lever by means of a pin yoke which allows the drawbar eye to be raised or lowered in engaging it with the pintle on the tractor. On the rear end of the trailer the standard pintle is fitted, which permits towing.

For loading the trailer two channels are provided which hook on the rear end, giving a ramp up which the guns can be hauled. These channels are detachable and are carried on the trailer frame when not in use.

The springs are interchangeable front and rear, being 42 in. long and 3 in. wide. The wheels are cast steel 36 by 6 in., adapted for demountable tires. There are eight spoke wheels and the tire fastenings are so arranged that the tires will be interchangeable with those used on the Nash and F. W. D. trucks. Throughout this trailer is designed to be interchangeable with the trailer used for the 3-in. anti-aircraft gun, in so far as similar products are employed.

For mounting the 3-in. anti-aircraft gun a trailer of 10,000-lb. capacity is provided. This trailer is a four-wheel

type, mounted on a wheelbase of 156 in. The frame is of pressed steel, spring supported on the front and rear axle and dropped for most of its length below the level of the supporting members at the axle. On the pressed steel frame is mounted a base plate suitable for attaching the gun to it, and the front and rear ends of the platform are covered by a steel plate ⅛ in. thick, forming a platform for the gun crew to stand upon.

The front end steering mechanism is similar to that of the 3-in. field gun trailer just described. There is also, however, a rear end steer, controlled by a bar or pole at the rear end. The rear wheels are locked in position when this pole is not in use, and the pole is carried in special brackets along the side of the trailer. A locking device is provided which is so designed that the pole cannot be withdrawn unless the wheels are in the center position. After the pole is withdrawn the wheels cannot be steered until it is re-inserted.

Front and Rear Axles Similar

The front axle is an I-beam section similar to that of the field gun trailer, and the front axle is dropped and carries the semi-elliptic spring overslung. The rear axle is similar in a great many respects to the front, being also a dropped I-beam section, with the same semi-elliptic springs overslung. The rear steering knuckles are forged and the spindles carry roller bearings which support the wheel load, as in the case of the front wheels. The brake drum is pressed steel, bolted to the rear wheels, in which the internal expanding brake operates. This brake is mounted on a 16-in. gun capable of holding the loaded trailer on a 20 per cent grade. The brakes are operated by a hand lever at the rear right hand side of the trailer. A seat and suitable foot rests are provided for the man operating the brakes. The frame on this trailer is 8 in. deep and is formed from ½-in. stock. It is braced at the rear end to take the Ordnance Department standard pintle and to allow for towing of another trailer of the same size as that described herewith.

In addition to the trailers described, the Grant Motor Car Co. is also making a 4-ton trailer suitable for carrying a number of bodies such as a repair shop, a cargo carrying body and other equipment. This is also a four-wheel type with single end steer. The drawbar connection is similar to the trailers described previously. The trailer is built upon a frame of standard 8 in. by 13¾ in. commercial steel, with channel side rails and front and rear cross rails. This framework is substantially reinforced by cross members of channel and I sections.

The wheelbase of the trailer is 156 in.; the track width, 72 in.; the frame length, 19 ft. 4 in., and the frame width, 44 in. overall. The axles are carbon steel forgings.

The front axle is a drop-forged I-beam section to which is bracketed a central supporting member carrying the steering lever. Pivoted to the steering lever on the center line of the trailer are two cross-arms, these connecting in turn with the steering knuckles and being so arranged that the trailer will track accurately behind the tractor which pulls it. The steering knuckles are drop forged and are the straight Elliott type. The wheels are mounted on roller bearings.

The rear axle is rectangular in section and is drop forged from carbon steel. The axles are 4 in. deep by 2¼ in. wide. As the rear axle is a dead member, the spindles are forged integrally with it and carry the wheels on roller bearings. The rear wheels carry the brake drums, in which operate the internal expanding brake shoes, which are controlled by a hand lever mounted at the front end of the trailer. The brake drums are 19 in. in diameter and the shoes are faced with asbestos fabric. The brake linkage is controlled by a straight pull rod from the hand lever. There is a ratchet on this lever which allows the brake to be locked.

The drawbar is a standard type, having a double coil spring housed within it. The drawbar is equipped with a spring mounted eye or lunette of 3 in. diameter and 6 in. outside diameter. Attached to the rear end of the trailer is the standard Ordnance type of pintle.

The springs are interchangeable and have main leaves of chrome vanadium steel. The other leaves are of carbon steel. The springs have an eye at one end and an arc at the other which rests over the rear spring mounting in such a way that the spring is free to slip over it when it lengthens, due to reflection. The length is 48 in. from the center of the eye to the center of the rear arc. The width is 4 in., the main leaf ⅜ in. thick, and the other leaves are 5/16 in. thick. The springs are held by two clips and the eyed ends are fitted with bushings of the proper size to take a 1-in. spring bolt.

The height from the top of the ground to the top of the frame when the trailer is fully loaded is 31 in. The live load on the trailer approximates 6600 lb. and the dead load totals 4400 lb. The tires are 36 by 6 in., pressed on, and the painting is in accordance with the standard camouflage specifications.

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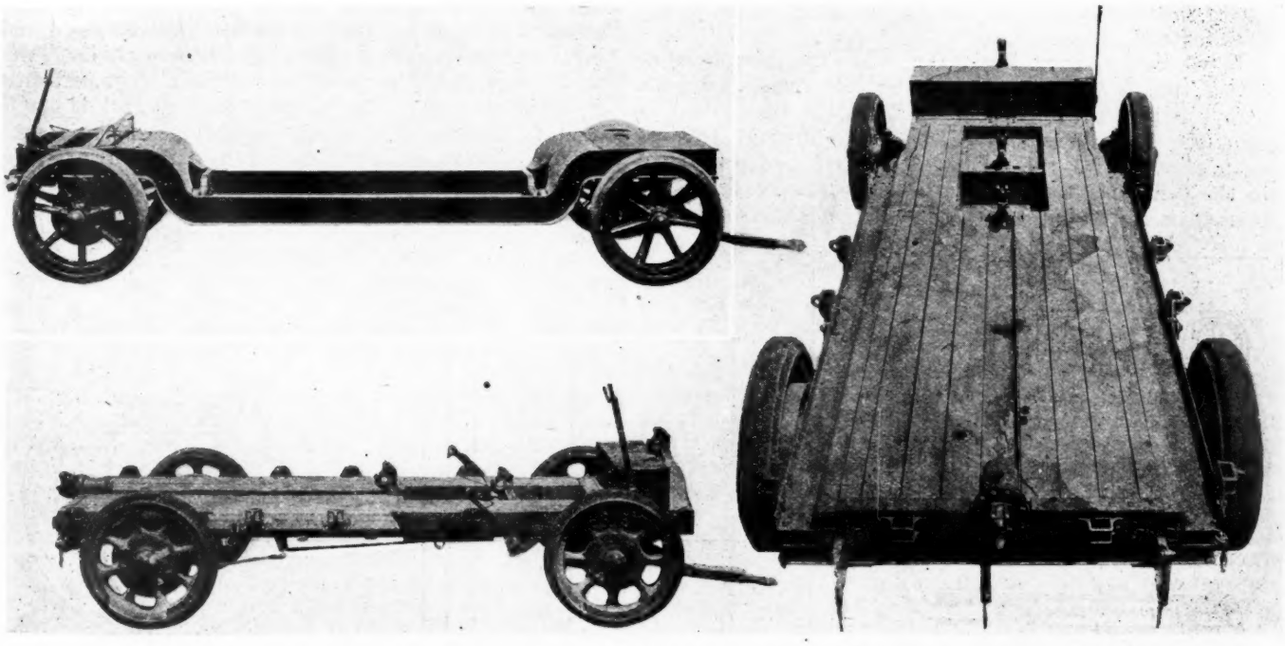
AS an extension of its factory betterment work, the New Departure Co. of Bristol, Conn., is installing shower baths for the men engaged in the hardening shop and other so-called hot departments.



Above—Trailer for anti-aircraft gun. Below—Three-inch field gun trailer Platform of the 3-in. field gun trailer

Thermostatic Generator Control Now Proved Success

Compensation for Atmospheric Temperature Found by Remy to Result in Saving of Battery Life

CARS equipped with the Remy thermostatically controlled generator have been on the road for about 18 months. This has given ample opportunity to observe the success of thermostatic control for automobile starting and lighting systems. The result has been found by the Remy company to be beneficial to battery life and the thermostat controlled generator is now used as standard equipment on the Harroun, Kissel, McLaughlin, Mitchell, Oakland, Olds, Paige, Reo, Scripps-Booth, Stanley Steamer, Templar, Velie, Atlas truck and Grant Denmo trucks.

The advantage of thermostatic control is based upon the fact that it requires more current for lights and for the starting motor in winter than in summer. The result of this is that the storage battery is more apt to be found in a drained condition during the winter months than in the summer. To meet this variation in demand for current, the Remy generator has been equipped for some time with the thermostatic control, which automatically reduces the generator output in summer time and increases it in winter.

The diagram, Fig. 1, shows the mechanical construction of the thermostat. A stamped steel bracket carries a resistance unit, a silver contact point and a thermal blade, insulated from the bracket and carrying a second silver contact point. The contact point in the thermal blade is held against the similar contact in the bracket, by the spring tension of the blade itself, at low temperatures. The blade is, however, made of a strip of spring brass welded to a strip of nickel steel, a combination which warps when heated, due to the greater expansion of the brass. The contacts are thus separated by the bending of the blade whenever the thermostat is heated to approximately 175 deg. Fahr.

It will be seen from Fig. 2 that when the thermostat is closed the field current takes the low resistance path through the contact points, but when the thermostat is open the field current is forced to go through the resistance unit. By this automatic insertion of resistance in the field circuit the generator output is reduced to a predetermined value. The operation of the thermostat is illustrated in Fig. 3. The generator output is 21 or 22 amperes after starting with a cold machine, and with atmospheric temperatures around 70 deg. the thermostat will open after 2 or 3 miles, which is sufficient time to make up the amount of energy taken from the battery in starting. When the thermostat opens the output will drop to 14 or 15 amperes at average driving speed. In very hot weather the thermostat will open much quicker. In extremely cold weather the thermostat will remain closed, insuring the continuous high generator output needed to meet the increased demand made by the starting motor and the increased burning of lights.

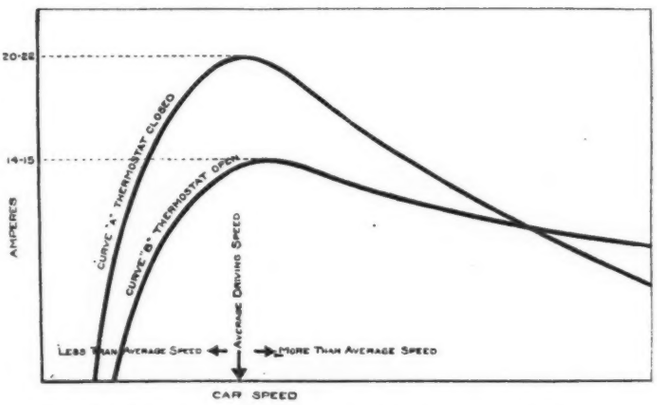


Fig. 3—Output curves with thermostat open and closed respectively

In addition to correcting the difference between winter and summer demands for current, the thermostat control makes it possible to keep the battery fully charged under unfavorable conditions, such as an exceedingly large number of starts, and the use of the car for a large percentage of night driving. The thermostatic control is supplementary to the third-brush regulation which is set to keep the charge rate from rising above the predetermined maximum of 20 to 22 amperes for a cold generator when the car is operated above the average driving speed.

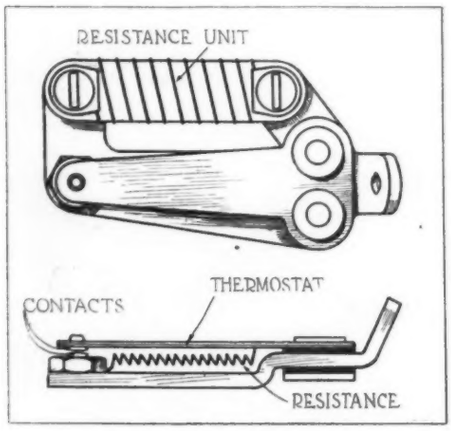


Fig. 1—Remy thermostat

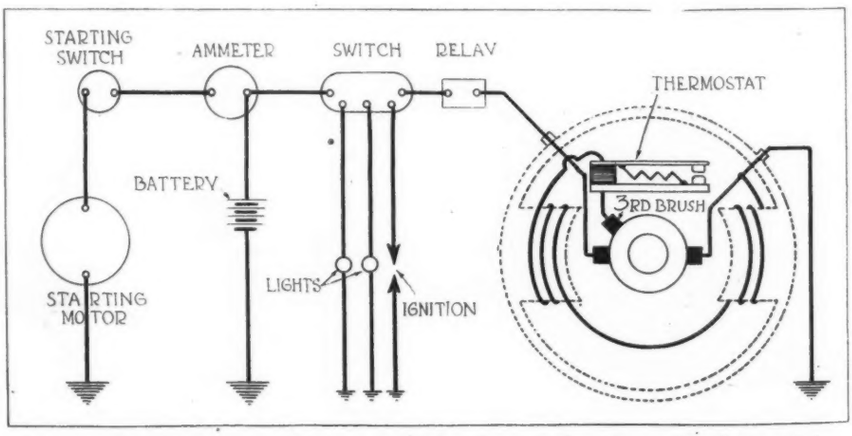
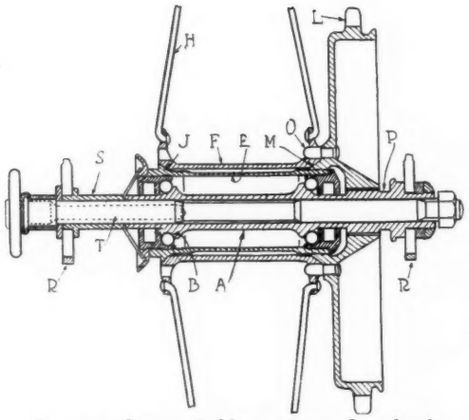


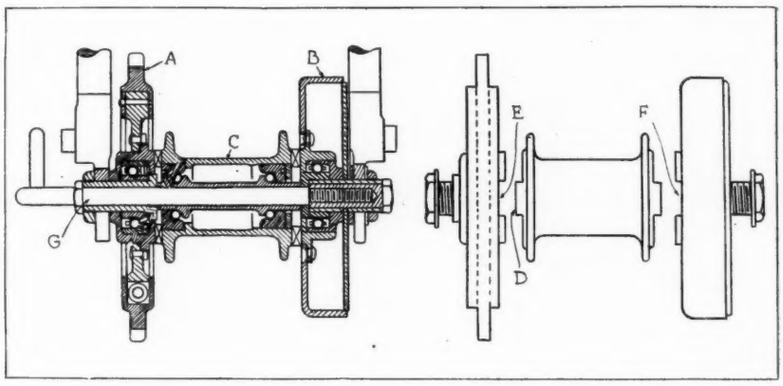
Fig. 2—Circuit diagram of Remy third brush control system with thermostat

Two New Demountable Motorcycle Wheels

In One the Driving Hub Is Driven by Pins in the Flange of Combined Chain Sprocket and Brake Drum—In the Other the Drive Is Through Hookham Joints



Comery demountable motorcycle wheel



Lechmere demountable wheel, driven through a Hookham joint

PATENTS have recently been issued by the British Patent Office on two designs of demountable wheels for motorcycles. The first of these is in the name of W. Comery, who is connected with the Raleigh Cycle Company of Nottingham. Mr. Comery forms the hub proper *E* as a separate fitting, which is mounted upon a hollow sleeve-like spindle *A*, the usual ball or roller bearings being interposed. The wheel is provided with a tubular, shell-like center *F* which is flanged on the outside to receive spokes *H* and is adapted to fit on to the hub *E*, an inclined projecting rim *J* on the latter engaging one end of the wheel center.

The sprocket wheel *B* is centered on a member *P*, secured to the frame, and is provided with an inclined surface *M*, adapted to engage with the adjacent end of the wheel center *F*, inter-engaging screw threads being provided on the driving element *L* and hub proper *E* to secure the same together, with the wheel center wedged between the two. When so connected, the driving element, wheel and hub are firmly locked together, projection *O* on one member entering recesses in the other. The member *P* secured to the frame is bored to correspond with the hub spindle, and a short sleeve or spacer *S* is correspondingly bored to complete the distance between the sides of the frame *R*, a removable bolt *T* being threaded through the three members and the side frame to secure them together, with the wheel in the correct position. The bolt may be bored and one end enlarged to form a lubricant reservoir, transverse holes being formed in the bolt and hub spindle to allow lubricant to be forced into the hub. When it is desired to remove the wheel, the two bolt *T* is withdrawn, the short spacer *S* removed, and the hub *E* is then disconnected from the driving element *L* which is left centered on the member *P* attached to the frame, the wheel and hub being removed bodily and then slid apart.

The other demountable wheel is patented by W. F. Lechmere of the James Cycle Co. of Birmingham. This bears considerable resemblance to the demountable wheel used on the U. S. A. motorcycle, in that the whole wheel construction is in three parts, which are fitted together by tongues and grooves. The sprocket wheel *A* is rotatively mounted upon a sleeve secured to the frame, and the brake drum *B* is rotatively mounted upon another sleeve secured to the opposite side of the frame, while the hub *C* is disposed between the sprocket wheel and the brake drum. Mutual engaging projections and recesses are formed on the outer spaces of the hub and the inner spaces of the sprocket wheel and brake drum, and a detachable, non-rotatable spindle passes through the hub and sleeves. Each end of the hub is provided with a diametrically disposed projection *D*, which is adapted to engage with the correspondingly shaped recess *E* in the sprocket, and a similar recess *S* in the brake drum. The hub is secured in position by means of a detachable spindle *G*.

—

Cellulose Acetate Dope

CELLULOSE acetate is the principal ingredient in dope for aeroplane wings, requiring for that purpose to be mixed with certain solvents. It is also used in film form for windshields for aeroplanes, etc., its main value for both these purposes lying in its non-inflammable character. It is employed for a vast number of peace time products, and by-products in its manufacture are of importance, both in war time and peace. In the manufacture of cellulose acetate the principal ingredients are paper or pulp and acetic anhydride.

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A New Type of Link Chain

A NEW type of chain made up of weldless links is being announced by the Cleveland Galvanizing Works Co. Hodell chain is made of flattened wire in a machine which, it is claimed, automatically rejects any wire which is imperfect. This machine loops the wire, bends it and laps the ends in such a way that the next link cannot drop back and wedge, as happens in ordinary flat chains. This, and the smoothly rounded contacts, due to the use of smooth drawn wire, give what is referred to as a roller bearing effect. The chain is claimed to be very flexible and free from any tendency to buckle and kink. A feature of value in the Hodell chain is the double thickness of the eye where the wear is greatest, and the reinforcement there which prevents the chain from flattening and lengthening under strain.

The Pfalz Single-Seater Fighter*

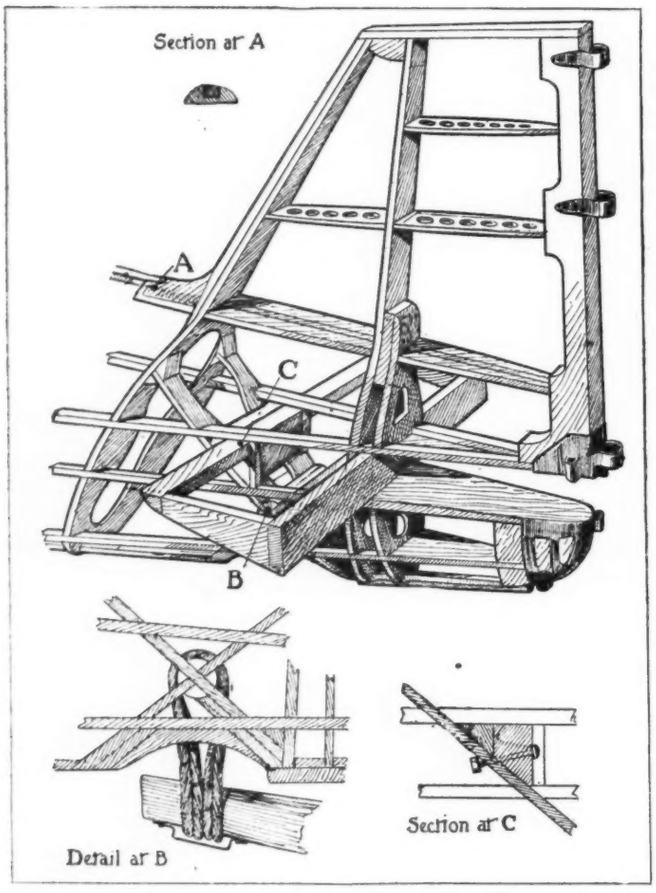
Part II

Mounting of Tail Plane, Tail Skid, Vertical Fin and Rudder and Construction of These Parts

At the stern the Pfalz body terminates, as shown in the illustrations, in a somewhat elaborate framework of wood, which performs the various functions of forming supports for the tail plane, tail skid, and vertical fin with its rudder. The second former from the stern is, it will be seen, sloped backward to form the leading edge of the vertical fin, and is reinforced above the body with other pieces of wood to give it a rounded edge. The last former is in duplicate, its front half extending upward to form a member of the fin, while the other half terminates just above the body and serves chiefly as a support for the short length of spar to which the front spar of the tail plane is attached. Between these two formers, and sloping so as to form in side view a cross, are two other formers, built up in much the same manner as the main body formers. The angle formed by one of these and the longeron accommodates the leading edge of the small plane permanently fixed to the body, while the point of intersection of the two formers supports a short transverse cylindrical piece of wood, around which are wrapped the shock absorbers for the tail skid. The details of both these joints are shown in the sketches. The small tail plane root is covered with plywood.

The tail plane itself is in one piece, and fits into the slot provided for it in the body. The manner in which it is secured after being placed in its slot will be clear from an inspection of the tail plane drawing. The front spar rests in the slot in the body, and is secured against lateral tilting by a steel band on each side, overlapping the butt joint between the front part of the rib and the tail plane root. The rear spar of the tail plane is locked in place by two long bolts and a stud. The two bolts are placed one on each side of the stern, as indicated in the sketch, while the stud passes through a lug welded on to the extreme rear of the steel shoe surrounding the heel of the *fuselage* into another lug near the foot of the stern post. The whole tail plane with its elevator can therefore be removed by undoing five nuts, and, of course, the connections in the elevator control cables.

*From *Flight*.

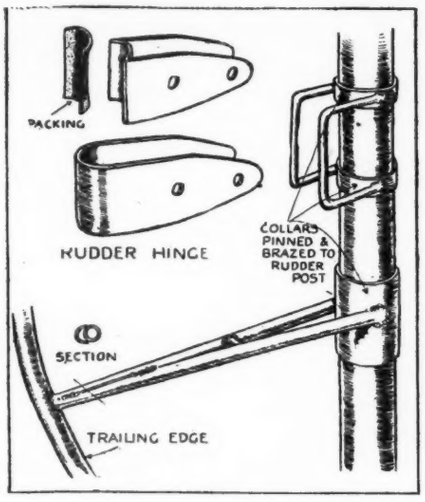


Framework of the stern

Tail Plane and Elevator

As regards the tail plane and elevator themselves, these are constructed along more or less standard lines and do not present any especially remarkable features. It has already been pointed out that the tail plane appears at first sight to have been put on "upside down," having a flat top surface and a convex bottom surface. The reason for this is not apparent, but it is possible that the disposition of the various weights and surfaces is such that there is either a lift-weight couple or a thrust-resistance couple or both, and that this section tail plane has been employed to equalize such couples. However, in a later machine captured and now at the Enemy Aircraft View Rooms the shape of the tail plane has been altered to a symmetrical section, so that it would appear that the "inverted" section has either been found unsatisfactory in practice or the reasons for its employment removed in a later design. Structurally the tail plane is built up of spruce spars with ribs having ash flanges and poplar webs. The inner ribs are covered with three-ply to give extra rigidity for attachment to the body. The front spar is of I section, while the rear spar is channel section, with recesses top and bottom for forming a flat surface with the rib flanges. There is no internal wire bracing, the necessary rigidity being obtained by means of diagonal ribs and by plates of three-ply placed over the joints between ribs and spars. The leading edge, which is also bent back to form the tips of the tail plane, is laminated as shown, and is lightened by spindling between the ribs. The laminations are probably steamed so as to be easily bent to form the rounded corners of the tail plane.

The elevator, owing to the fact that the rudder has no downward projection, is in one piece, and is built up in a manner similar to that of the tail plane. Its leading edge is formed by a box spar, and the ribs are similar to those of the tail plane. The attachment of the ribs to the trailing edge is somewhat unusual. Instead of the flanges of



Steel tubular frame of rudder and rudder hinge

the ribs passing over the trailing edge they are thinned down and pass into a slot in the trailing edge. They are then secured in place by a small metal clip. The slots in the trailing edge appear to have been made with a circular cutter of about 3 in diameter, the ends of the rib flanges being placed where the slot is deepest. The elevator hinges are formed by forked bolts passing through the rear spar of the tail plane, and corresponding with eye bolts through the leading edge of the elevator.

The elevator crank levers are of a type frequently found on German machines. The crank itself is of stream-line section and is welded to a channel section base plate surrounding three sides of the leading edge. Another base plate of similar shape, but made of lighter gage, is slipped over the leading edge from the front and forms a washer for the hinge bolt, which passes through the leading edge at a point coincident with the crank lever. The attachment of the elevator and rudder cables to their respective cranks is in the form of a ball and socket joint, or, more correctly speaking, the ball portion of it is not a complete ball but a slice of a sphere, formed integrally with the bolt passing out of the socket into the barrel of the wire strainer. The socket, and also the ball, have a flat formed on one side so as to prevent the ball from turning in the socket. Behind the ball a small split-pin passes transversely through the socket, thus preventing the ball from dropping out of the socket when the control cables are removed. The socket is kept filled with grease.

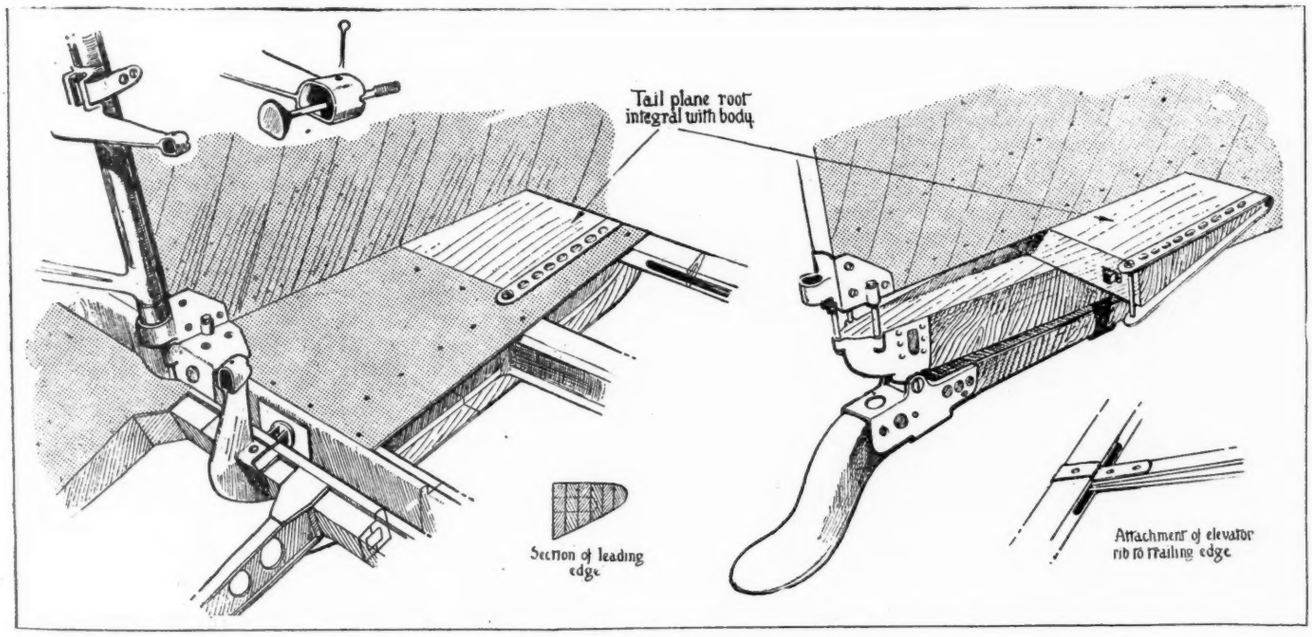
The rudder, which, as already pointed out, is placed wholly above the elevator, is built entirely of steel tubing. The ribs are joined, not directly to the rudder post, but to a collar of very light gage, which is in turn pinned and braced to the rudder post. The object of this construction probably is to avoid weakening the rudder post by welding, since all the rudder ribs can then be welded to their collars on a jig, the rudder post being inserted afterward and the collars pinned in place.

The rear end of the ribs is joined direct to the trailing edge by welding. The method of tapering the rib tubes down toward the trailing edge is different from anything we have yet seen on a German machine. A vertical slice is taken out of one of the tubes, and the edges thus formed are pushed over the other tube of the rib, the two tubes being held together by short welds at intervals.

The foot of the rudder post rests in a cup or shoe on the trailing edge of the vertical fin, while additional hinges are provided at intervals. To prevent the rudder post from sliding up and down a collar is placed above and one below each hinge. To these collars are welded two U-shaped rods around which is wrapped fabric in order to form an airtight joint at the points where the hinge pierces the rudder covering. In the illustration the fabric wrapping has been omitted for the sake of clearness.

The tail skid is of somewhat unusual shape, as shown in the right-hand sketch. Owing to the fact that there is no vertical fin below the body of the Pfalz, and no downward projection of the rudder, it has been possible to reduce the head resistance of the skid by making it horizontal for the greater part of its length, with just a downward curve at the rear to give greater clearance for the tail plane. The skid is pivoted on a bolt passing through a lug on the heel of the *fuselage*. Its free end is sprung by rubber cord from the short cylindrical piece of wood already referred to. This attachment looks remarkably weak—a piece of wood, slotted at its ends to fit over the cross formed by the two sloping body formers. Yet in all the captured specimens of Pfalz machines that we have had an opportunity to examine, this particular member has never been broken. As to the skid itself, it is built up of ten laminations of wood, each about 5 mm. thick. At the rear the skid is provided with a sheet metal shoe to protect it against wear.

(*To be continued*)



Some tail plane details of the Pfalz biplane

Some Outstanding Problems in Aeronautics*

Part III

Problems of Propeller Design—Propellers with Adjustable Pitch—Stability and Control—Armament and Instruments

By Dr. W. F. Durand

WE shall now turn our attention for a few moments to one of the most intricate and hence one of the most interesting of the many problems presented to us by the aeronautic art, that of the airscrew or propeller.

The function of the airscrew is, of course, to take the torque of the engine and to transform it into a propulsive thrust; or otherwise to take the power given by the engine to the crankshaft and transform it into driving or propulsive power for the aeroplane. The problem is further complicated by the fact that expressed in terms of a power relation, it is not simply the question of an engine handing so much power over to the airscrew for the latter to transform into propulsive power. Instead, the power which the engine itself can develop is dependent on the propeller and likewise on the aeroplane to which they are both attached. We have here, in consequence, a series of complicated implicit relations, and from which the propulsive characteristics of the plane-propeller-engine combination take their origin. In fact, it must never for a moment be forgotten that the moving aeroplane is in effect an aeroplane-motor-propeller combination and that no one of the three can be determined independent of the other two.

Influence of Airscrew

Without entering into any detailed discussion of this problem, it will be clear that the airscrew will exercise a controlling influence on the power which the engine can develop. Thus, it is evident that an aeronautic engine, in order to develop power, must be permitted to move its pistons, to revolve its crankshaft; in other words, to make revolutions; and other things equal, the power developed will vary directly with the revolutions which are realized. Again, it is easy to see that the size and amount of surface of the airscrew blades will present a controlling feature regarding the revolutions which *can* be realized. Thus, the airscrew may be enormously over size, too large in diameter and presenting a large and unwieldy surface to the air. Suppose this to be the case with a plane of size suited to the airscrew but not to the engine. That is, the engine is far too small for either airscrew or plane. In such case the engine simply will not be able to make its normal number of revolutions. It will be held down by the excessive resistance to rotation presented under such circumstances, and may thus develop far less than the normal power which it is capable of under proper conditions. Many other combinations may occur which we cannot stop to discuss or even to mention. Broadly speaking, the plane, the engine and the airscrew, as the propelling agent, form a most closely knit combination and each interacts in a more or less controlling manner on the operation of the other two.

In order even to make a start with the problem of the airscrew it is therefore necessary to assume conditions regarding both the plane and the engine. If these conditions, as assumed, are then realized in practice and if the design has been well carried out, the anticipated results may be reached. If, on the other hand, the assumed conditions are not realized as regards the plane and the engine, then no matter how well the design of the airscrew may have been carried out, the anticipated results will not be realized. Hence, no matter how good the airscrew may be by itself, no matter how carefully designed and constructed, no matter how faithfully it may be able to realize the conditions for which it is designed, if these are not the conditions under which it is actually placed for service, the results, economic and otherwise, will be unsatisfactory; not necessarily by reason of any fault in the airscrew as such, but due simply to its lack of adaptation to the conditions of operation. An effective airscrew is therefore not only one which is properly designed and constructed in itself, but also one which is permitted to operate under the conditions intended and contemplated in its design.

All this is, of course, well known, and if I have taken the time to repeat these well-known facts, it is the more clearly to bring to our minds at the present moment the fact that the airscrew represents not only a problem in itself, but also one of adaptation to and of usage with the proper combination of plane and of prime mover.

The general problem of the airscrew is by no means, however, to be classed distinctively as outstanding. Instead, an enormous amount of work has been done on it, both theoretically and experimentally, and in its main features it has been brought fairly within the limits of a solved problem. There have been three modes of approach, briefly, as follows:

Three Methods of Treatment

(1) The analysis, geometrically, of the blade of an airscrew into a series of elements, occupying each a narrow strip running across the blade from leading to following edge and making up, by their summation, the blade as a whole. Each of these elements or strips is then considered as, in effect, a little elementary aerofoil and for which the usual aerodynamic characteristics are readily determined, either by direct experiment on a model, or by selection or interpolation from and among the large amount of available data regarding such aerofoils which have already been submitted to experimental investigation. With such data in hand relating to the series of elements going to make up the blade, it is a matter of simple computation to combine them in such manner as to represent the action of the blade as a whole, under the conditions assumed, and thus in general terms the problem is solved.

(2) A law of similitude is assumed and a small model propeller is tested out experimentally and under conditions which permit, under the law of similitude assumed, the translation of the *observed* results for the model into the *probable* results for the full sized airscrew.

(3) Full sized airscrews are tested out as nearly as may be under flying conditions and are made the ultimate basis of design.

*Sixth Wilbur Wright lecture read before the Aeronautical Society of Great Britain at London, June 25.

The limitations of method No. 1 arise from the following:

(*a*) The coefficients derived for aerofoils correspond to straight line motion between the air and the foil, whereas, in the airscrew, the relative motion is in a helical or spiral path.

(*b*) The actual velocities for which such coefficients are derived are usually for speeds not exceeding 60 or 70 miles per hour, whereas the actual speeds of the tip elements of airscrew blades may move at speeds of 500 m.p.h. and upward. The extent to which the usual square of the speed law may be extended to such values is not as yet fully known.

(*c*) The coefficients used are derived for the various aerofoil sections or elements individually, whereas, in the actual airscrew, they all act conjointly or collectively in making up the airscrew blade.

Application of the Three Methods

Application of method No. 1 cannot therefore be made except in so far as it is justified by actual and final experience on full sized forms under flying conditions.

Method No. 2 (that with reduced size models) has the limitation that the law of similitude employed is, of necessity, not exact but approximate, and the degree of reliance which can be placed on results thus found can again only be determined by ultimate reference to full sized forms under flying conditions.

Method No. 3 (that with full sized forms under actual flying conditions) has the limitation of very high cost, both in equipment and time, and as a result of which only a relatively small number of forms can actually be subjected to adequate test in this manner.

Again, method No. 1 (that of computation based on coefficients determined by laboratory experiment) has the advantage of requiring only a pencil and pad of paper with a table of predetermined coefficients. No. 2 (that with the small models) has the advantage over No. 3 of relatively small cost, of permitting the tests to be carried out in a wind tunnel with all conditions under control, and finally it permits of carrying quickly through the test program a very large number of types and forms. It should perhaps be stated here that as between methods No. 1 and No. 2 the latter is accepted as much the more reliable of the two. In fact, it is not too much to say that when used with judgment it furnishes a very satisfactory and well-nigh universally accepted method for dealing in a laboratory way with most problems of airscrew design and operation.

Parts of Problem Still Unsolved

If we have tarried so long over these phases of the problem of the airscrew propeller, present methods of design, etc., it is in order to bring into clearer relief the parts of the problem which are not yet well in hand—the parts which *are* as yet outstanding and waiting our further study.

These phases which thus stand out represent in effect the lack of an adequate correlation between the three methods of approach as above described.

It is obvious that if we could develop an adequate and reliable correlation between the results of the computation according to method No. 1 and the final test under flying conditions according to No. 3—if, in other words, we could adequately determine the error of No. 1 and hence the correction to be applied in any given case, then a pencil and pad of paper would go a long way toward furnishing the material for the solution of the problem of airscrew design, once we are permitted, of course, to assume a definite set of operative conditions.

Or again, if we could know more accurately and more widely the character and amount of error to be anticipated in the use of the small models according to method No. 2, we should be in a position to use the experimented model method with better assurance of definite and reliable results for the full-sized screw later to be constructed.

It seems likely that this final correlation of computation with ultimate result may best be made in two stages. The first should comprise a careful study of the relation between the results derived by the computations of method No. 1 and the model tests of method No. 2. Such a correlation would then permit us to pass readily from the results by computation to the probable results by model.

The second correlation should then comprise a series of comparative tests to determine with sufficient generality of application the character and amount of correction to be applied to the results of model tests in order to satisfactorily reproduce the results to be expected from full-sized forms.

This would, by no means, require the testing of a full-sized form corresponding to each model. If so, there would, of course, be no use in making model tests. The whole program might as well be carried out directly by tests on full-sized forms. It appears reasonable to expect, however, that a well selected and not too numerous series of tests, properly distributed among the various characteristics of form and of operation, would serve adequately to give the correlation desired.

With such correlations established we should then have two methods, Nos. 1 and 2, available for the design of airscrews. No. 1 available with no more than a pencil and a pad of paper (once the standard section coefficients determined), and No. 2, by model, ready to supply a vast amount of detailed information regarding operation under varying conditions, and which may be realized rapidly and effectively once the model is made.

If we have spent so much time over these matters relating to the airscrew, it is because of its importance as an element in aerial navigation, and in order that we may the better note just what part of the general problem is still outstanding.

This, as we have seen, lies primarily in the matter of the correlation between the three methods outlined. There is indeed need for continuing experimental research, especially on systematically selected forms, both model and full size; and such continuing experimental work combined with carefully directed studies of correlation will go far toward giving us an assured and adequate basis for the practical solution of the airscrew problem as applied to aerial navigation.

Reaction Between Airscrew and Plane

Perhaps the widest and most important outstanding problem in connection with aeroplane propulsion has relation to the reaction between the plane and the propeller—the influence of the structures adjacent to the propeller on its performance, economic and otherwise, and the influence of the propeller on the plane, both as regards its lift and its net resistance to propulsion. This is a field which is largely outstanding. It must be attacked chiefly by the experimental method—by model with results checked up by comparison with full scale trials so far as practicable. Time forbids more than the mention of this promising and largely uncultivated field of aerodynamic investigation.

Of a closely related nature is the problem of the interaction of two or more airscrews on one shaft. This is a problem which is becoming of importance in connection with the increase in power of aeroplane power plants and with the fitting of more than one airscrew on the same shaft.

This likewise is a problem which must be approached experimentally—again through model research checked up by comparison with full scale tests. A beginning has been made on this important and interesting problem, and we may expect, in a not distant future, to find it brought within limits of control similar to those surrounding the problem of the individual airscrew.

Airscrew with Adjustable Pitch

In addition to these problems which relate to aeroplane propulsion in its general aspects, and more especially when for the sake of simplicity we assume that the aeroplane remains under a uniform regimen as regards external conditions, there arises a problem of very great present importance, that of some form of adjustment in the technical characteristics of the aeroplane—propeller combination permitting it to be made responsive to variations in the regimen of operation, as for example, change in the density of the air due to change in altitude, or change of regimen required for climbing flight as compared with horizontal flight.

In connection with the prime mover, mention was made of the very important problem of maintaining power at altitude in spite of the decrease in the density of the air. In reality this problem is very intimately bound up with another

of scarcely less importance, that of devising means for effectively using such power for propulsive purposes. Without attempting any technical discussion of the question, it will be apparent that the whole problem of the operation of the airscrew as a means for absorbing the power of the prime mover and converting it into the propulsion of the plane will depend on the density of the medium in which and on which it operates. Again, in climbing flight a part of the weight of the aeroplane is carried by the pull or thrust of the airscrew. In horizontal flight it is all borne by the planes (assuming the airscrew shaft then horizontal). Hence, the pull or thrust of an airscrew and indeed its whole regimen of operation may vary widely according as the plane is climbing or flying horizontally. It thus seems reasonable to conclude that for the best results there should be provided some mode of adjustment or compensation so that the airscrew, as it finds itself operating in a medium of continuously decreasing density, or as it finds itself called upon for varying amounts of thrust or pull with varying angles of climbing flight, may be correspondingly adjusted in order to give continuously the best results.

The problem is further complicated by the fact that the aeroplane itself needs a correlative adjustment. As we have already seen, the one factor in aerial flight which remains sensibly constant under all conditions and at all altitudes of flight is the weight of the plane and its equipment. The vertical supporting force gained from the reaction of the air must therefore be maintained constantly equal to this weight at least for the conditions of horizontal flight, while for climbing flight the weight will be divided and borne partly by the supporting planes and partly by the airscrew. The problem of the economic use of power at varying altitudes and under varying angles of climbing flight involves therefore the following chief elements:

Chief Elements Involved In Use of Power

The weight of the plane.
The surface of the wings and their aerodynamic characteristics.
The angle of attack of the wings.
The speed.
The power developed by the engine.
The revolutions of the airscrew.
The area and form of the blades of the airscrew.
The pitch of the airscrew.

These various factors react and interact in a most complex manner, and any attempt to discuss the problem in detail would carry us too far afield on the present occasion. Reference has already been made to the problem of wing surfaces, adjustable either in area or form. Such adjustments are, however, not yet available, and at present the angle of attack is the one feature about the plane which may readily be varied. On the other hand, there is no feature of the propulsive agent, the ordinary airscrew which admits of equally simple correlative variation. What is needed with regard to the airscrew is, indeed, some means of realizing an adjustment correlative to the change in the angle of attack for the plane. To this end a change of pitch is most suitable, some means of varying, at the will of the pilot, the pitch of the screw in order that with the fixed diameter and area of surface, and with the work available per revolution of the engine as affected by the density of the air, the pitch may be so adjusted as to secure the number of revolutions best adapted to the economic use of the power given out by the prime mover. This will then insure the thrust needed to overcome the resistance of the plane at the angle of attack and speed which, taken conjointly, will give the lifting force needed to support the weight of the plane, either in whole or in part, according as the plane is flying horizontally or climbing.

Two Problems Involved

All of this somewhat complicated statement means simply that what is wanted is an airscrew with blades adjustable for pitch. Such an airscrew may be realized by so pivoting the blades that they may be turned about a radial axis, thus changing their angle relative to the axis of the screw itself. Extreme changes of such a character result in a very wide variation of pitch from roof to tip and in the end will result in a serious loss in efficiency. There are therefore two problems involved:

(1) The aerodynamic problem of determining the best form and proportions of an airscrew, the blades of which are intended to be pivotable in this manner, so that under the widely changing conditions of flight which may be met with, there may be effective operation and a well sustained efficiency.

(2) The mechanical problem of so designing and building an airscrew with adjustable blades that it will meet the rigorous requirements imposed upon it by the exacting conditions of aeroplane navigation.

It is perhaps not too much to say that the first problem is already well in hand. We know reasonably well what forms and proportions to give to such an airscrew, and if it were only a matter of design or of the determination of form and proportion, the problem could hardly be called outstanding.

As much cannot be said regarding the second problem. The practical construction of an airscrew with adjustable blades is not an easy matter. Several modes of construction have been attempted, but with only moderate success. The problem is clearly defined, of the highest order of importance, and is outstanding as one of the appliances for which the art of aerial navigation is definitely in waiting.

Three Fundamental Requisites

The three fundamental requisites of an aeroplane are strength, movement and stability with control. We have noted some of the problems arising under the requirements of strength, and movement or propulsion. We may now turn very briefly to a glance at the situation regarding stability and control. Any detailed discussion of these problems would be quite out of the question on the present occasion, and time in any event will only allow us a brief glance at the general situation.

Regarding stability and control it is not too much to say that the general principles underlying these characteristics of an aeroplane are now reasonably well understood, due largely to the splendid theoretical and experimental investigations initiated by British scientists and to which certain workers in the same field in the United States may have contributed something, and by no means overlooking certain important contributions by French and Italian investigators. These investigations, both analytical and experimental, have placed the study of these subjects on a reasonably sure foundation, and have served to mark out the way to secure any desired degree of stability which may be desired or which may be consistent with other valuable qualities. We are here confronted with one of those situations, so frequently encountered in scientific and technical work, where a choice must be accepted on some middle ground between wide extremes, and where the attempt to secure some desirable quality in high degree may lead to a limitation of desirable qualities in other directions.

Desirability of Extreme Stability

So it is with stability and control. If stability is carried to an extreme then mobility and quickness of maneuvering are reduced and control in the sense of ready response is lacking. For military purposes, especially for machines of the fighting type, where mobility is of the highest importance, this would be a serious shortcoming, and hence such machines cannot be given too much stability in the ordinary sense of the term. On the other hand, for heavy machines of the bombing type, where mobility of evolution is not so vitally important, the margin of stability may be greater. Going to a still further extreme, it is perfectly easy to build a safe moderate-speed family carriage sort of machine which will be stable and secure, under almost any conditions likely to develop. Such machines would be scorned by fighting pilots, but when civil aeronautics begins to come into its own after the war and under peace conditions, and there comes a demand for safe machines for civil purposes, including family outings for the week-end from the city to the country or to the seacoast, then we may anticipate a larger recognition of the qualities making for safety and stability, and we shall find machines provided having such characteristics and in practically any desired degree. Here again, however, there will be degrees of choice, because it will be found that

with too high a degree of stability, what may be termed the riding qualities of the plane will be poor, while with low stability the riding qualities may be much smoother.

The general problem is therefore pretty well solved so far as the ground work is concerned. This does not mean, however, that there is nothing further for us to learn in this connection. There are many problems of a detailed nature inviting the student of this fascinating field of study, and the solution of which will serve to round out and broaden our general grasp of the subject. In particular, we need further study on the interaction between elements which insure stability and those which permit mobility and readiness of response to control agencies, to the end that we may control more effectively the combinations which may be desired regarding stability and mobility of evolution.

Again, while the elements of control are well understood, there is room for further study as to the best means of actually developing the control forces required and of applying them to the plane itself. These are partly aerodynamic and partly structural problems, each phase reacting more or less on the other.

An Example

One instance of problems of this character will serve to illustrate the type.

Thus, we know that an aeroplane is provided with rudder surfaces of two kinds, one to determine movement in a vertical direction, up or down, and the other to determine horizontal motion, right or left. But these motions, vertical and horizontal, assume that the plane itself is horizontal or sensibly so. However, when a plane is circling on a steep spiral or making a quick turn, it is inclined or "banked," in order to avoid side slipping, until, in extreme cases, the wings are nearly vertical, and frequently much more nearly vertical than horizontal. In such cases, the functions of these control services are reversed. Those which, with normal aspects, serve to produce movement right and left will now serve to determine motion rather in a vertical direction, and those which formerly served for movement up and down will now serve to determine motion to the right or left. For intermediate angles of bank, each set of control surfaces will give control forces in both directions, up or down and right or left.

Now, it is by no means sure, having in view this double and interchanging function between these two sets of surfaces, whether we have as yet realized the ultimate and best arrangement either as regards the surfaces themselves or their control by the pilot.

It seems decidedly probable that we have not and that some arrangement yet remains to be devised which will be more effective in the matter of this double and interchanging function of control, and simpler in its relation to the pilot.

This and other like problems are still awaiting investigation and offer a delightfully promising field for the further study of the aerodynamic engineer.

There still remain two large and important fields, rich in aeronautic problems. These are armament and instruments. I shall attempt no more than the briefest general reference to these two classes of problems.

Those arising under the head of armament are, of course, strictly military in character, and but little of interest could, in any event, be said in a public address. Such problems relate naturally to the number, type and size of guns to be carried, their mounting and special sights; bombs and devices for carrying, aiming, dropping, etc.; questions of armor and protection of vital parts against gunfire or shrapnel bursts, etc.

Expressed in their most general terms, these problems resolve themselves into an attempt all along the line to meet the requirements imposed by the desired military uses of the plane, and to anticipate or improve upon the devices and designs of the enemy in the same fields.

Regarding instruments, little more specific can be said. This field does, however, bristle with problems of the highest interest to the scientist, and may well challenge his best efforts. It is interesting to note the extent to which the modern aeroplane has become a flying meteorological and physical laboratory. Thus, a recent list of aeroplane instruments shows some 25 or 30 different instruments and devices, not indeed all to be carried on one plane, but all included in the general aeronautic militray program, and each serving some specific and important purpose.

With these instruments, as with armament, the problems reduce themselves to an effort to meet the military or the navigational and operative requirements of the situation, and in these days of war in particular, to anticipate or improve upon the similar devices and designs of the enemy.

Much of the work relating to these problems under armament and instruments is already done and well done. There do remain, however, many problems, especially of detail or of improvement, and which must be considered as outstanding; but of these I shall attempt no mention or discussion.

By way of conclusion, reference may, for a moment, be made to a problem of the most vital and far-reaching economic importance, and which will be upon us with the arrival of peace conditions. This is the problem of the best economic utilization of the enormous investment which has been made in aeronautic production, expressed in terms of money and human time and energy, and now represented by factories, machinery and equipment, finished product, trained industrial organizations, human skill and productive capacity.

And so with all our problems; we can only look hopefully forward for the future to give to us such measure of answer as our patience and study may merit.

Of one thing, however, we may be sure, and that is that the day will never come when we have no more problems to solve. But, on the contrary, the number of problems still outstanding, as the years go by, is likely, rather, to increase with our acquaintance with the subject, and we may be sure that before this or any like audience under the auspices of the Aeronautical Society of Great Britain there will never lack material for a discussion of "Outstanding Problems."

A Trophy Show

British motorcycle machine-gun men with their trophies. It will be noticed that the machine guns are mounted on side cars

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Sixteen-Cylinder Engines

AS the multiplication of cylinders in automobile engines had been carried to the point marked by the twelve-cylinder or twin six, it was to be foreseen that in aircraft engines, where very much larger powers are called for, this number would be exceeded. One of the first steps beyond the twelve was the so-called W type of engine of 18 cylinders for which a well-known English designer was responsible. It received considerable publicity at the time of its appearance, but little has been heard of it since. The engine was laid out to give uniformly spaced explosions, and, consisting of three sixes on a six-cylinder crankshaft, it was, of course, in absolute balance so far as reciprocating parts are concerned. Probably the most objectionable feature of the engine was its necessarily considerable frontal area and consequent high parasitic resistance. This resistance is less the greater the number of cylinders that are placed in a row and the fewer the number of rows.

A comparatively small parasitic resistance may also be achieved with a 16-cylinder type engine, as the natural angle of V for such an engine is 45 deg., the angle of the Liberty engine. As compared with the 12-cylinder 45 deg. V engine, the 16-cylinder has the advantage of evenly spaced explosions and it also possesses an advantage in respect to parasitic resistance, because with the same cylinder dimensions, arrangement of accessories and general design of the crankcase, the parasitic resistance due to both engines should be alike, while the power output of the 16 would be 33 1/3 per cent greater.

As regards mechanical balance, the 16 is probably not quite as good as the 12. This depends somewhat on the manner of arranging the crankshaft. In all-in-line eights, it has been the custom to use what is virtually two four-cylinder crankshafts joined end to end and set at right angles to each other as regards the throws. We have, therefore, two four-cylinder engines end to end with their cranks rigidly held in synchronism. Each engine has an unbalanced secondary inertia force having twice the frequency of crankshaft rotation. The secondary inertia force of one engine is a function $\cos 2\theta$, where θ is the angle its crank has passed through from the top dead center position, and the secondary inertia force of the other engine or set of four cylinders is a similar function of $\cos 2(\theta + 90^\circ = \cos 2\theta + 180^\circ)$. But the cosine of an angle plus 180 deg. is the negative of the cosine of that angle, hence the two secondary inertia forces will be equal and opposite to each other. However, since one force acts near one end of the engine and one near the other, they do not cancel each other but result in a rocking action in a plane through the crankshaft.

The arrangement of the crankshaft described is undoubtedly used because of the ease of its manufacture. By having alternate throws of the crank at right angles the rocking moment can be almost eliminated.

All the above arguments relate to eight-cylinder engines. Since the inertia forces are reciprocating forces acting in a single plane, those due to one set of cylinders in a V engine cannot be balanced by those due to the other set. Therefore, the balance of a sixteen-cylinder V engine is the same as that of an eight having the same crank design.

Skilled Acetylene Welding

THE art of acetylene welding will undoubtedly be greatly advanced by the large-scale manufacture of aircraft engines, for most of these engines involve numerous welding operations, some of them of a most difficult nature. Acetylene welding has now been practised for more than a decade, and such welding equipments are found in repair shops all over the country, yet the number of expert operatives is none too great. An ordinary repair job, such as welding up a crack in a cast iron cylinder or an ordinary break in any casting, is easy enough to handle, but when welds have to be made between

very thin sheet metal parts, as is required in welding up the jackets and valve fittings of an airplane cylinder, more than usual skill is required if a neat job is to result. Practice, of course, makes perfect, and with the large amount of work of this class now needed a great many welders will become very proficient at the job.

The Employment Department

THERE is real cause for wonder at the late germination and slow growth of a good idea in the fact that, measured by the length of time that other modern industrial methods based on the same fundamental principles have been in general use, the employment manager's department is still very new and in fact, is as yet unknown, in may industrial orgaizations.

Isn't it a bit odd and rather hard to explain that industry as a whole should have so long failed to appreciate the importance of the scientific, not to say the semi-intelligent, selection of its labor elements? Isn't it difficult to understand why we should not long ago have seen, without being shown, the advisability of having our industrial hiring done by one department in each plant with special knowledge, training and equipment for the job instead of leaving it to foremen, superintendents and department heads who, having vacancies to fill, fill them with whatever type, manner or character of applicants happen to apply, if they measure fairly well up to certain not clearly defined standards of their own creation?

Imagine the state of things which would result from having the buying of materials and supplies done in this same decentralized and disorganized manner.

The advantages of the purchasing agent are apparent. The results of his efforts are readily observed, measured and appreciated. With the employment department, however, it is not quite so easy to determine just what benefits are derived, particularly when by benefits we mean financial return. These benefits are real but they do not make themselves so directly manifest. They are hard to calculate on a dollar and cents basis except after a comparatively long period of time.

Now that the United States Government has taken a strong hold of the labor situation and pretty well controls the unskilled supply, the employment manager has become an industrial agent in whose doings the Federal authorities take a direct and active interest. Labor is so scarce, it must be used economically. Every man must do what he can do best. The worker must be assigned to the kind of work for which he is best fitted through past experience, temperament and natural inclination. It is no time, from either the point of view of the individual manufacturer or the nation as a whole to permit waste effort and inefficiency resulting from unscientifically combined men and jobs.

The Government is so thoroughly alive to the importance of the efficient distribution of labor that it is conducting courses of instruction for the training of employment managers.

Americanization from the Practical Point of View

THE manager of an electrical equipment manufacturing plant chiefly engaged now on Government work, recently complained that the greatest obstacle in the way of obtaining desired and necessary production in his organization is not so much a lack of workers or capacity of equipment as it is indifference on the part of the operatives. He described this indifference as a lack of patriotism, as a failure to appreciate the need for whole-hearted and continuous effort at this particular time. He disclosed the fact that most of the operatives who manfested a spirit of disinterestedness were foreign-born, but not enemy aliens. Patriotism does not, of course, move such as these. What this plant needs, and so we told its manager, is to be Americanized.

Others, many of them, have met this same condition. In many plants, forced to run with a large proportion of a lower grade of foreign-born and often non-English speaking workers, there is noted a very marked check on production, beyond a certain comparatively low limit which arises from indifference on the part of these workers to the benefits of piece-work rates and other inducements which seemingly should affect their selfish natures, but apparently do not, beyond a given point. There is evidence aplenty that Americanization in such cases will work wonders, that it will do what bonuses, premiums and other usually effective production stimulants fail to accomplish.

Americanization, that is industrial Americanization, is not, as the condition described will testify, a philanthropic movement. It is purely commercial, purely a production building undertaking. And the fortunate part is that it benefits both employer and employed, one as much as the other, if indeed it does not benefit the latter more. This, however, from the point of view of the employer, is merely incidental. His interest in the movement lies in its practical results as they may be observed in his business records.

Looking at Americanization in this coldly practical way, it can be said that it has been found to be a good, and in many cases a necessary, investment. Workers, to be good workers, to be the kind of workers that make for maximum production, must have the American point of view. They must have American ideals and ambitions. They must first of all speak and read our language. They must like our country well enough to become citizens of it. They must feel that their home is here and that this is the land in which they will experience the realization of their highest hopes.

A number of our big business organizations have come to realize the importance of this great truth. In our own industries there are several excellent examples of what can be done along this line. There should be more and those who apply the principles involved should not be only the larger concerns. The smallest one in any industry is not too small to benefit by the thorough Americanization of its employees.

□ Latest News of the

Motor Trucks Under Quartermaster

Colonel Glover Placed in Charge of Purchasing, Production and Procurement of All Vehicles by Order of General Goethals

WASHINGTON, Sept. 11—Following closely upon the creation of the Motor Transport Corps, new orders innaugurated by Major General George W. Goethals, assistant chief of staff, take the purchase, production and procurement of motorized army vehicles from the new corps and again place these duties under the Quartermaster Department in charge of Colonel Fred Glover who was transferred from supervision of this work less than a month ago.

Colonel Edwin S. George, who worked with Colonel Glover and was also transferred, is again in charge of production.

Colonels C. B. Drake, James F. Furlow and C. Seamon remain in charge of the Motor Transport Corps which now controls the engineering, operation and maintenance of motorized army vehicles.

Rearrange Whole Plans

The Motor Transport Corps will instruct Colonel Glover of the army needs and it will be his responsibility to meet these requirements.

Complete rearrangement of practically the entire army plan of operation preceded these moves. At the direction of General Goethals who is also Director of Purchase, Storage and Traffic, orders were issued recently and speedily making him the direct chief of all purchases and ordering General W. Wood, Quartermaster General, to report directly to General Goethals. Following this, additional orders were as speedily promulgated taking the control of purchase, production and procurement from the Motor Transport Corps and again placing it under Colonel Glover.

These changes come most abruptly regarding the program of army truck activities. There has been considerable jockeying for control of the army truck activities. First there was the Motor Transport Section of the Quartermaster Department in charge of trucks under Brig. General C. B. Baker who favored the standardized trucks designed especially for the army. Last spring, after continuous attacks upon these war trucks, the control of trucks was taken from General Chauncey B. Baker. A Motor Transport Service was organized under Colonel F. Glover with the aid of General Goethals. Tests were held and some of the standardized war trucks were discarded in favor of standard makes of trucks. After about 10 weeks of control and following Secretary Baker's return from Europe, the Motor Transport Service was abolished, Colonel Glover was transferred, and the Motor Transport Corps was created with the same men in charge who had been under General C. B. Baker. This was within the last 30 days. Now comes the new abrupt change, following Secretary Baker's return to Europe, with Colonel Glover again in charge.

The opinion was expressed in Washington that the creation of the Motor Transport Corps with the regime favoring standardized trucks in charge meant that the truck policy of the Army was permanently settled. Officials told of past lobbying and politics and claimed that the "election was over." Apparently they were incorrect. A recount, it seems has been taken.

At the same time that General Goethals was hurrying these orders through, it appears that those interested in maintaining the Motor Transport Corps were rushing orders through to gain more substantial control for that Corps. The orders from General Goethals were somewhat speedier and more powerful.

In consequence of these rapid changes civilians and officers, four weeks ago under the Motor Transport Service, suddenly found themselves under the Motor Transport Corps and now as abruptly find themselves in the Quartermaster Department as all those connected with purchase, production and procurement, including the branch offices in New York, Cleveland, Detroit and Chicago some under Colonel Glover. It is expected that there will be some transfers, resignations and appointments.

Changes Cause Confusion

As a result of these many changes considerable delay and confusion exists. While the changes have been in process army truck plans have been neglected. In addition there is the confusion of the reorganization. Up to late last week the Motor Transport Corps had no knowledge of the new change and proceeded to build up an organization calling upon many important individuals who in turn proceeded to give up their present connections to come to Washington. Some of these men have arrived and they do not know now what positions they hold or what to expect.

Following is a circular by General Goethals explaining the organization of and assignment of duties as regards purchase in the Army, and also the supervision of the Quartermaster Department.

Subject: Organization of the Division of Purchase and Traffic, General Staff

1. Organization of and assignment of duties in and under the direction of the Division of Purchase, Storage and Traffic, General Staff, shall be as follows:

(a) **Office of the Director of Purchase, Storage and Traffic, General Staff.**—Duties: Responsibility for and authority over—

(1) Supply of the army, including analysis and computation of requirements, purchase, production, inspection, acceptance, transportation, storage, issue within the United States and embarkation.

(2) Relations with all other agencies, governmental and otherwise, in regard to army supply, including representation of the War Department on the War Industries Board and business with representatives of the allied governments.

(b) **Facilities Department.**—Duties: Responsibility for and authority over procurement of real estate.

(c) **Accounts Department.**—Duties: Responsibility for and authority over disbursements, fiscal accounting, preparation of estimates, and reports of accounts.

(d) **Traffic Department.** — Duties: Responsibility for and authority over inland transportation.

(e) **Embarkation Department.** — Duties: Responsibility for and authority over embarkation and ocean transportation.

2. (a) The Quartermaster General of the the Army shall report to the Director of Purchase, Storage and Traffic.

(b) The Quartermaster's Department, in addition to its other duties, shall have responsibility for and authority over storage, distribution, and issue within the United States of all supplies for the army.

(c) The chiefs of all other bureaus corps, and departments of the army shall report to the Director of Purchase, Storage and Traffic on all matters enumerated in section 1 (a) hereof.

3. The present supply organization of the army shall continue as heretofore until changed by orders issued by this office from time to time.

By authority of the Secretary of War.

GEO. W. GOETHELS,
Major General, Assistant Chief of Staff, Director of Purchase, Storage and Traffic.

—

Motor Transport Corps to Consist of 154,774 Men

WASHINGTON, D. C., Sept. 12—An additional statement regarding the Motor Transport Corps was issued here to-day and says that this corps will eventually number 154,774 men. The army motor trucks with this corps will number 40,803. There will be 24,250 motorcycles, 7905 passenger cars, and 6598 ambulances with a total of 100,000 riders and drivers. There will be 4298 officers and 30,090 noncommissioned officers. The executive organization will comprise 3122 men and 679 officers and the total repair personnel in the 273 service parks which will be constructed for the upkeep of the vehicles, will comprise 34,319 men, mostly trained mechanics.

Each additional American army will require a similar motor transport personnel and it is expected that by the time the United States has 4,000,000 troops in France, 500,000 of them will be engaged in motor transport work. The Motor

(*Continued on page* 478)

Automotive Industries

To Maintain Average Truck Output

May Produce During Last Half of Year One-Third Made During Last 18 Months

NEW YORK, Sept. 10—Manufacturers of motor trucks are to be permitted to maintain production during the last half of 1918 at the average reached during the past 18 months. They are to receive priority ratings in class B4 for such materials as may be necessary to produce during the period July 31 to Jan. 1, one-third of the number of vehicles produced for civilian use during the whole of 1917 and the first half of 1918.

The certification of Priorities Certificates which will enable manufacturers to obtain raw materials and parts already has been commenced by the Automotive Products Section of the War Industries Board, and these are now being cleared by the Priorities Division. Such certificates, it is pointed out by the National Motor Truck Committee of the N. A. C. C., cover only vehicles intended for civilian uses, which take a B4 rating under the ruling of the War Industries Board, and not trucks built for war purposes, which may take a higher rating.

It is believed that manufacturers of road tractors, trailers, truck attachment units of the truck-former type and body builders who build for the trade and do not dispose of their entire outputs to manufacturer will come within the same classification as the truck manufacturer. Where they have not already done so, they will be required to supply the Automotive Products Section with sworn statements of their production during 1916, 1917 and the first half of 1918.

In its statement, the National Motor Truck Committee says: "It is felt that the board will not look with favor on any increased production beyond the average of the last 18 months. Indeed it will be disappointed if sales are not reduced. In view of trucks being sold only to essential industries, it is expected that substantial savings will be made from past production. So you should constantly bear in mind that the number you may be permitted to make by the terms of the Industry Certificate issued you does not justify you in making such number unless such number is necessary to supply your demand from essential industries."

In those cases where production of individual companies shows a reduction during the first half of 1918 as compared with the previous year, due to heavy production of military vehicles, the allotment has been reduced to a basis of the production for the first six months of 1918, on the expectation that continuing or expected additional war orders will counterbalance the reduction; and in cases where companies were not in real production during the last of 1917 the allotment has been based on the average of production during the time they were in production.

When approved by the Priorities Division, certificates will be mailed or delivered to the manufacturer. These will authorize him to purchase the necessary materials to complete the specified number of trucks and will contain a form of affidavit which must be attached to each order for material. This affidavit is the only receipt needed by the supplier to release the materials.

The new arrangement supersedes the older one requiring individual priority certificates for each order. Priority certificates that have already been filed with the board will not, therefore, be acted upon.

—

Urge Abandonment of Shows

WASHINGTON, Sept. 12—Following the cancellation of the National Automobile Shows by the National Automobile Chamber of Commerce the Chamber and the War Industries Board are urging promoters of local shows for automobiles trucks or accessories to abandon all plans for such during the coming winter to save fuel, labor and transportation.

In a statement issued here to-day it is said that the Chamber cancelled the 1919 shows at the request of Bernard M. Baruch and George M. Peek of the War Industries Board. Following a meeting here between Baruch, Peek, Alexander Legge, Judge E. B. Parker and all of the War Industries Board and Hugh Chalmers and Alfred Reeves of the Chamber, a letter was sent to the Board to the effect that the Chamber concurred unanimously in the opinion of the Board and adopted the following resolution:

"Resolved that the promotion of National Automobile Shows during the winter of 1918-1919 with consequent use of transportation, fuel and labor would in the opinion of this body be inconsistent with patriotic obligations of the industry and that therefore national shows be suspended until further action of the association.

Resolved that the reasons expressed in the foregoing resolution promoters of local and other shows be respectfully requested not to hold automobile truck or accessories exhibitions during winter 1918-1919."

Preference List of 74 Industries

Aircraft Leads Activities Entitled to Preferential Treatment—To Name Plants

WASHINGTON, Sept. 8—Seventy-four industries are named in a new preference list, just compiled and issued by the War Industries Board, as the primary industries of the nation, entitled to preferential treatment because of war or national interest demands. The industries, named, together with a list being compiled of 6500 individual plants engaged in whole or part on war work, will receive preferential treatment through priorities on all matters of:

Fuel	Materials
Labor	Transportation
Capital	Facilities

The list will also be used by the War Department as the guide for allowing industrial exemptions from the draft.

The numerous factories listed individually are so handled because the industries to which they belong were not entitled to preferential treatment as a whole. "In numerous instances," says the War Board, "individual plants have been found entitled to high preference while the industry to which they belong is not."

Motor trucks for example are not specified in the list of industries and those truck plants entitled to preference treatment will be listed individually, as will passenger car and motorcycle manufacturers engaged in work entitled to preference in priorities.

The industries are arranged in four groups, group No. 1 being the most important. While those in group No. 2 are chiefly more important than group No. 3 and No. 3 is more important than No. 4, there are many instances where an industry though no more important than another is given a higher class rating because its production is not equal to the demand and special preference is extended in order to supply the materials, transportation or labor as the case may be, so that the production of that industry may be speeded.

The industries named that are of particular importance because of their connection with automotive activities are as follows. The group classification is also shown:

Aircraft	I
Ammunition	I
Small arms	I
Blast furnaces (producing pig iron)	I
Brass and copper (plants engaged prin-	

(*Continued on page* 483)

Restrictions in U. S. Affect Canada

No Maker of Complete Cars in Dominion—Dependent on United States for Parts

MONTREAL, Sept. 10 — Some people might imagine that the Canadian end of the industry is not much affected by decisions of the U. S. War Industries Board, but a little thought will show the fallacy of this. Canada does not possess to-day an automobile manufacturing plant that is complete in itself.

Most of the parts of the cars that are made in Canada are, it is well known, manufactured in the United States and are assembled in Canada, only a small proportion of the actual production being done in this country. This is unfortunate, but it is nevertheless true.

Shortage of Steel

Consequently any restrictions that are put upon the manufacture of parts in the United States affect the supply to Canada, and it is sure that the industry in the States is not going to supply Canada when it cannot supply its own needs. This particularly applies to steel, while apart from this the Canadian Government regulates every pound of steel that comes into the country, and it is so much needed for munitions work that there is not even any available for the manufacture of rails for the railroads.

There will be practically no new models for 1919, for not only are the designers engaged in more important work but with the increased restrictions on manufacture there is no object in making expensive experiments now in order to secure an improvement which with the rapid strides that engineering science is making under the stress of war may have to be discarded for something better when the war is won.

Trucks and Tractors Only Hope

Dealers who are hard hit by present conditions are keeping a smiling countenance and doing the best they can with what is at their disposal, hoping always for the best.

The only automobile construction work that is likely to be done anywhere in the Dominion next year will be in the building of trucks and of tractors and other automobile machinery which will aid in the production and transportation of necessaries. There are some agencies in Montreal that have already been notified that the passenger car portion of their firms has been entirely suspended and that the trucks are all that will be turned out in limited quantities for the general market.

The agents will presumably turn their attention to the development of the truck industry, and in this way the restrictions that are being placed on the whole industry will be somewhat of a blessing in disguise. So big has been the demand for passenger cars in the past that agents who have handled both truck and passenger cars have not devoted so much attention as they might have done to the transportation vehicle.

—

Canadian Ford Stops Dividends

WINDSOR, ONT., Sept. 6—The Ford Motor Co. of Canada has only paid 5 per cent in dividends to shareholders in the past few years, and announces that further dividends will not be paid for some time to come. This is due principally to the fact that all the reserves were used in purchasing materials with which to keep the plant in operation, not merely for the next season but for several years.

During 1918 selling prices have been increased 20 per cent, while the cost of production has increased 24 per cent, compared with a 7 per cent decrease in selling prices and a 14¾ per cent increase in cost for 1917.

A comparative balance sheet of the Canadian Ford company for the past 4 years follows:

Accounts receivable and stock on hand	1918	$8,498,260
	1917	5,167,039
	1916	4,916,197
	1915	2,678,651
Cash on hand	1918	177,252
	1917	2,066,455
	1916	486,655
	1915	2,609,977
Plant extensions	1918	1,072,495
	1917	400,000
	1916	1,067,934
	1915	1,359,557
Tax payments	1918	84,309
	1917	596,239
	1916	286,486
	1915	697,323
Percentage increase in stocks and plant	1918	42%
	1917	28%
	1916	46%
	1915	31%
Percentage of increase in stocks and plant bears the following proportion to profits	1918	211%
	1917	95%
	1916	137%
	1915	47%

	Selling Price	Cost Prod.
Percentage of selling prices and cost of production	1918—Inc. 20%	Inc. 24%
	1917—Dec. 7%	Inc. 14¾%
	1916—Dec. 10%	Inc. 9%
	1915—Dec. 9%	Inc. 6¼%

		Selling Price
Wages percentage of total expenditure on production	1918	16%
	1917	16%
	1916	22%
	1915	21%

—

Tire Filler Makers Convene

CHICAGO, Sept. 9—Twelve manufacturers of tire filling products have called an "Automobile Tire Economy Conference" to be held in the Congress Hotel, Sept. 15 to 18. The object of the gathering is to form a national association of standard tire filler manufacturers and to submit to government bureaus a wartime program for salvage of tires. Frank D. Mayer is temporary secretary. The tire filler manufacturers interested are: The Essenkay Products Co., Chicago; Peerless Tire Filler Co., Chicago; Dahl Punctureless Tire Co., Minneapolis; Pan-American Rubber Co., Milwaukee; National Rubber Filler Co., Midlothian, Tex.; Panama Rubber & Euipment Co., St. Louis; Wolverine Tire Cushion & Accessory Co., Detroit; Rubberair, Inc., New York; Bettern-Air Co., Philadelphia; National Synthetic Tire & Rubber Co., New York; Universal Tire Filler Co., Portland, Ore.; National Tire Cushion Co., Kansas City.

First Jobber Exhibit Abandoned

N.A.A.A.J. Ascribes Same Reason as N.A.C.C.—Municipal Pier Show to Be Held

CHICAGO, Sept. 9—The National Association of Automobile Accessory Jobbers has decided not to hold its show, which was scheduled for the week of Oct. 28 to Nov. 2, at Medinah Temple. The reasons for calling off the exhibition are the same as those given by the National Automobile Chamber of Commerce for calling off the national shows. It is probable that the annual convention of the N. A. A. A. J., which is to be held at the same time, will be carried through with the show feature eliminated. This decision was announced in a bulletin sent to all members Saturday by Commissioner William Webster.

Abandonment of the national motor car shows at New York and Chicago and the jobbers' show leaves the exhibition at the Municipal Pier, known as the National Exposition of Automotive Accessories, as practically the last event of the kind on the program. This exhibit, which opens Saturday, Sept. 14, and runs until the following Saturday, has a good list of exhibitors, particularly of accessories. In addition, there are a number of tractor, truck, truck former, and parts manufacturers who are among the list of exhibitors. Passenger car exhibits will be only incidental.

It is probable that the Pier show will benefit somewhat by the discontinuance of plans for the jobbers' exposition, because there undoubtedly are several jobbers who will take space in the Pier show now that the one at the Temple is not to be staged. Reservations of space are being held open until Wednesday on this account.

Arrangements have been made in connection with the exhibition at the Municipal Pier for a series of conventions to be held there, among which are agricultural organizations, hardware trade and others.

Plans are all in shape for the opening Saturday and the decorations are about completed and the novelty of the show at the Pier may be depended on to attract a number of people who otherwise would not attend. Transportation facilities are exceptionally good, parking space for hundreds of cars being provided and both the surface lines and bus lines provide other transportation.

—

England Has Repair Problem

LONDON, ENGLAND, Aug. 20—A recent report shows that there are now in England several thousand motor vehicles awaiting repair and that this number is practically three times what it was a year ago. In France it is reported there is almost an equal number of vehicles in this condition. It is expected that it will take two or three years to put all of these vehicles in good order and dispose of them following the com-

pletion of the war. On the completion of the war there will be a great number of trucks, automobiles, motorcycles and spare parts, as well as machinery that will be brought from France to England, which will represent the value of many millions of pounds. Spare parts for motor vehicles now in government stores are valued at $25,000,000.

—

Wrench Makers Conserve

NEW YORK, Sept. 6—Manufacturers of drop forged wrenches have adopted a war conservation program for the period of the war. They will discontinue immediately the manufacture of regular finished wrenches in addition to a long list of other wrenches which are considered unnecessary. Semi-finished wrenches may later be eliminated also and their place taken by what is styled a war finish wrench which will be equally as good as the others though slightly different in appearance.

Wrenches will no longer be packed in separate envelopes and all-wooden boxes, and sample and display boards for advertising them are eliminated. The lines retained as necessary are: Engineers' wrenches, check nut wrenches, light cap screw wrenches, hexagon box wrenches, square box wrenches, flat handle "S" wrenches, set-screw wrenches, tool post wrenches, single-head socket wrenches, spanner wrenches, construction wrenches, structural wrenches, round handle track wrenches, car wrenches and light service wrenches, all of which have useful functions to such an extent as to make their elimination doubtful from the viewpoint of conservation.

Those discontinued are all so-called heavy cap screw wrenches, including all millings from those blanks; 22½-deg. angle or textile wrenches, including all millings from that line of blanks; concave "S" wrenches, machine wrenches, long flat handle wrenches, double-head socket wrenches and all miscellaneous wrenches not mentioned in the above paragraph.

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Fordson Distribution in Canada

DETROIT, Sept. 9—Arrangements have been made whereby the Fordson tractor will be handled by the Ford Motor Co. of Canada, Ltd., through its branches and dealer organizations from coast to coast. Shipments have been made to Ford dealers throughout this section. The tractor will sell to the consumer at $950 f.o.b. Dearborn, plus the freight to destination. The Canadian government had 1073 tractors delivered to the various provinces in accordance with arrangements made with Henry Ford & Son as a means of assistance in the production campaign carried out by the Canada food board.

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Wood & Spencer Expands

CLEVELAND, Sept. 6—The Wood & Spencer Co., engaged in the manufacture of machine parts for airplanes and other war munitions, has leased two parcels of land directly in the rear of the factory. The property, which is 78 by 158, was acquired for expansion after the war.

Export Lines Drawn Tighter

New Regulations Restrict Licenses to American Firms or Allies of America

WASHINGTON, Sept. 10—New export regulations, effective after Sept. 20, 1918, regarding requests for export licenses, have been made public to-day by the War Trade Board as follows:

Hereafter licenses may be granted by the War Trade Board only upon application of the consignor and only to—

(1) Corporations organized under the laws of the United States, or of any State, Territory, or Possession of the United States or of the District of Columbia, or

(2) Residents of any State, Territory, or Possession of the United States or of the District of Columbia, or

(3) Foreign partnerships with a member who is a resident of any State, Territory, or Possession of the United States, or of the District of Columbia, or

(4) Foreign corporations actually maintaining in any State, Territory, or Possession of the United States or in the District of Columbia an established branch or agency for the regular transaction of its business, or

(5) Any foreign government acting through any member of its embassy or legation accredited to the United States, or

(6) The Traffic Executive of Great Britain, France, Italy, and the consul for Belgium, or

(7) Any official, firm, or corporation appointed by any department or agency of the United States Government to act in its behalf.

Applications for export licenses and supplemental information sheets and any other supplementary documents or letters relating thereto will only be considered by the War Trade Board when filed by such corporations, firms or individuals and only when signed in ink by—

(a) An official duly authorized to act on behalf of a corporation if application for an export license is made by a corporation.

(b) A member of a firm, if application for an export license is made by a firm.

(c) An individual himself, if application for an export license is made by an individual.

(d) A regular employee of a corporation, firm or individual making an application for export license if such employee has been duly authorized in writing to so sign on behalf of such corporation, firm or individual and if such authorization has been filed with the War Trade Board.

(e) An attorney in fact of a corporation, firm or individual making application for an export license, if such attorney has been properly authorized so to act by virtue of a power of attorney duly executed and filed with the War Trade Board.

(f) A person duly authorized to act in their behalf if application for an export license is made by a foreign government, the Traffic Executive, the consul of Belgium, or an agency of the United States Government.

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Canada Has 237,172 Cars

MONTREAL, CANADA, Sept. 10—The Montreal Automobile Association has compiled the following statistics of automobile licenses issued for 1919 to date in the various provinces:

Prince Edward Island	564
Nova Scotia	7,290
New Brunswick	1,500
Quebec	23,337
Ontario	97,500
Manitoba	22,214
Saskatchewan	44,267
Alberta	27,000
British Columbia	13,500
Total	237,172

Ontario also has registered 7000 trucks in addition to passenger cars.

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Australia Needs Battery Men

SYDNEY, AUSTRALIA, Sept. 2—Facilities for looking after storage batteries in some of the more remote sections of Australia are so chaotic that they practically do not exist. In many of these places there is no possibility of getting a battery charged or even buying distilled water for it. The automobile owners in these territories know how to drive cars and that is about all.

Owners of cars requiring their batteries recharged in many cases send them 120 miles where they are charged at the silver mines, where charging is done as a favor by the mine manager or engineer. The mine manager frequently makes distilled water and is dominated by the thought that so long as the water is thoroughly boiled and allowed to cool off, it can be classed as distilled water.

This whole situation points to the need of American manufacturers giving some aid to Australian automobile dealers who ask that certain of their cars be fitted for such a country as this. This calls for magneto equipment and elimination of the electric starting and lighting equipment. Many large owners of sheep farms, or station owners, as they are called, have no facilities whatever for making electrical repairs, and the difficulty of handling a car with complete electrical equipment becomes very apparent. This does not mean that the electrical systems are not good, but while they are ideal for the most populous sections of Australia, they are not fit for the more remote sections which are developing into large car-buying areas.

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Detroit to Care for Wounded Soldiers

DETROIT, Sept. 10—Plans are being made by the employment department of the Detroit Board of Commerce to take care of incapacitated soldiers and sailors returned from service, and the co-operation of industrial plants has been requested in the work.

July Exports Are 1% Below June

Tractor Engines and Airplane Parts Show Substantial Gains for Month and Year 1918

	1918 Cars	Value	Tr'ks	Value	Parts
July	3,442	$3,624,870	601	$1,527,519	$2,771,193
June	3,098	2,808,463	829	2,001,488	3,195,353
	1917				
July	5,089	3,627,217	1,388	3,562,755	2,139,938

WASHINGTON, Sept. 10—Exports of passenger cars, trucks and parts (not including engines and tires) during July amounted to $7,923,582, as against a total of $8,005,304 for the previous month, a loss of but little over 1 per cent When compared with the total for July, 1917, the falling off for the month is approximately 15 per cent.

A greater number of passenger cars were shipped during July than was the case in June, but both months fall far behind the total for July, 1917.

Exports of commercial cars show a steady decrease from those of 1917, but the value of parts, although lower for the month, show a gain on the year's figures. A significant increase is shown in both the number and value of tractor engines exported. This classification includes engines used for military tractors of creeper type. It should be noted that airplanes exported for military use are not included in the figures given.

Australia proved to be our best customer for passenger cars in July, the United Kingdom leads as a truck buyer and the substantial car exports to Latin-American countries indicates improved shipping conditions. Airplane parts exported during July were valued at $1,913,127 as against $261,565 for the same month of 1917.

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$5 a Day Granted by Canadian Ford

FORD CITY, ONT., Sept. 9—Approximately 2500 employees of the Ford Motor Co. of Canada, of which 1900 are employed at the Ford City plant, will benefit by the new $5-a-day wage scale for 8 hr. which took effect to-day. This will affect every employee of the Canadian plants who has been in the service of the company for 3 months or more. The former minimum wage was 50 cents an hour. Canadian plants are located at Montreal, Toronto, London, Winnipeg, Saskatoon, Calgary, Vancouver and St. Johns, N. B. War conditions and lack of material have compelled the company to cut its staff considerably, but it is using all the men possible at the present time.

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August Acme's Record Month

CADILLAC, MICH., Sept. 9 — The Acme Motor Truck Co. had the best month in its history during August. More trucks were sold and more delivered than at any other time since the Acme was placed on the market, and the outlook for future business is reported by officials to be most satisfactory. More agencies are being established and the company's advertising campaign is proving very effective.

New York's Exports Drop Slightly

July Figures Show a Gain in Passenger Cars and Parts —Trucks Show 46% Loss

NEW YORK, Sept. 9—Although during July both cars and parts exported showed a gain when compared with the figures for June, the falling off in truck exports was sufficiently large to bring the grand total below that of the latter month.

The comparative values are as follows:

	Cars	Trucks	Parts
June	$1,495,346	$1,370,955	$767,276
July	1,667,464	741,132	1,068,384

The grand total for July is $3,476,980 as against $3,633,577 for the previous month. July's exports were a trifle better than those of May, which showed a total of $3,339,558.

Chile was our best customer for passenger cars in June, taking delivery of 287 during that month. Australia heads the list for July with 293 passenger cars.

Evidence of better shipping facilities is given by Spain taking 87 cars as against 3 during June, and our trade with Latin America is well maintained. Japanese China and Ireland appear in the July table and France's purchases represent over half our month's truck exports in number and two-thirds of the total value.

Exports of Automotive Equipment for July and Six Previous Months

	Month of July				Seven Months Ending July, 1918			
	1918		1917		1918		1917	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	.....	.....	9	$120,465	7	$44,645	136	$1,059,207
Airplane parts	.....	$1,913,127	.....	261,565	.....	7,443,615	.....	2,419,641
Commercial cars	601	1,527,519	1,388	3,562,755	5,508	13,705,235	8,574	20,621,248
Motorcycles	740	159,664	941	196,041	6,249	1,452,367	10,174	2,158,991
Passenger cars	3,442	3,624,870	5,089	3,627,217	26,033	24,205,056	41,124	30,748,942
Parts, not including engines and tires	.....	2 771,193	.....	2,139,938	.....	19,033,619	.....	17,094,321
Total (trucks, cars and value parts only)	.....	$7,923,582	.....	$9,329,910	.....	$56,943,910	.....	$68,464,511
ENGINES								
Automobile gas	3,698	$730,772	1,932	$204,497	19,816	$2,617,144	18,981	$2,186,707
Marine gas	457	115,891	844	149,168	3,126	1,409,865	6,622	1,267,096
Stationary gas	1,919	209,685	2,078	188,004	16,971	1,945,914	17,178	2,053,806
Tractor gas	1,212	1,292,806	785	943,297	16,202	16,081,106	4,243	8,257,018
Total value	.....	$2,349,154	.....	$1,484,966	.....	$22,071,709	.....	$13,764,627

EXPORTS BY COUNTRIES JULY, 1918

	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Argentina	150	$230,125	1	$3,250	1,219	$1,194,409	43	$39,863
Australia	460	425,443	.....	.....	49	33,498	.....	.....
British India	4	6,000	.....	.....	2,704	2,203,868	.....	.....
British South Africa	.....	.....	.....	.....	664	539,619	.....	.....
Canada	357	281,916	103	165,083	7,274	5,960,916	804	1,007,718
Chile	101	139,053	.....	.....	1,162	1,444,415	.....	.....
Cuba	214	335,912	38	78,057	1,252	1,678,428	316	648,355
Denmark	.....	.....	.....	.....	2	4,100	.....	.....
Dutch East Indies	214	273,417	.....	.....	396	481,372	.....	.....
France	156	111,486	128	503,802	664	915,160	1,459	5,412,496
Mexico	162	147,120	.....	.....	1,308	892,399	.....	.....
New Zealand	197	169,529	.....	.....	976	790,586	.....	.....
Norway	36	92,190	.....	.....	47	124,438	.....	.....
Philippine Islands	195	224,996	.....	.....	1,282	1,071,138	.....	.....
Russia in Asia	.....	.....	.....	.....	.....	.....	.....	.....
Russia in Europe	.....	.....	.....	.....	4	1,720	2	5,454
Spain	87	100,844	.....	.....	436	532,789	.....	.....
United Kingdom	3	8,957	184	547,677	338	957,202	1,616	4,757,638
Uruguay	183	161,221	.....	.....	1,116	653,787	.....	.....
Other Countries	923	916,661	147	229,650	5,140	4,725,167	1,268	1,833,715
Totals	3,442	$3,624,870	601	$1,527,519	26,033	$24,205,056	5,508	$13,705,235

Rubber Imports Decline

August Receipts 5,671 Tons Behind Last Year—Six Months Total Is Ahead

NEW YORK, Sept. 10—Imports of crude rubber slumped considerably during the month of August as compared with July, the net decrease being 5671 tons. During July, 16,092 tons came in as compared with 10,421 tons in August. The total for the year to date is still ahead of the total for 1917 up to the same time, though the ratio of increase has dropped slightly as compared with the total to the end of July. There has been a gain of 3321 tons imported as compared with a similar gain of 10,189 tons reported at the end of July for the seven-month period.

During the first eight months the total quantity imported was 125,891 tons. This compares with a total of 122,661 tons that came in during the same period in 1917. Following are the statistics as compiled by the Rubber Association of America:

Month	1917 Tons	1918 Tons
January	12,788	16,084
February	10,162	13,108
March	18,624	17,161
April	13,000	12,703
May	18,411	16,288
June	15,096	24,124
July	17,290	16,092
August	17,290	10,421
Total	122,661	125,981

Ryan and Baker in France

WASHINGTON, Sept. 9—Secretary of War Newton D. Baker, accompanied by John D. Ryan, Second Assistant Secretary of War in charge of military aircraft, has arrived in France. It is expected that a complete investigation of aerial activities and aircraft needs will be made. Secretary Baker, accompanied also by the Chief of Embarkation and the Surgeon General, intimated before leaving that the purpose of his journey would be made clear by the interests of the men who crossed the Atlantic with him. Coming closely after the Senate Military Affairs Committee airplane report, the sudden decision of the Secretary of War to visit Europe is taken by many here to mean an intensive study of air needs and possibilities at the front.

Gear Makers to Meet Sept. 20-21

SYRACUSE, Sept. 9—The semi-annual meeting of the American Gear Manufacturers Association is to be held at the Onondaga Hotel, Sept. 20 to 21. Following is that portion of the program which has been completed: "Priority," Charles A. Otis of the Priority Committee; "What Is the Possibility of Women Becoming a Permanent Factor in the Gear Industry," W. H. Diefendorf; "Trade Acceptances," C. E. Crofoot; "The Outlook of the Steel Supply," C. E. Stuart, secretary and treasurer of the Central Steel Co., Massillon, O.

Canada Conserves Gasoline

MONTREAL, Sept. 10—Canada has fallen in line with the policy which went into effect across the line a few days ago of conserving gasoline by refusing to sell to owners on Sundays. The Imperial Oil Co. has led the move, and all Imperial service stations in Canada will be closed on Sunday, this ruling to be effective for the duration of the war. An announcement has been received from Ottawa which will make the measure Dominion wide.

Gasoline and Oil Exports Run Into Big Figures

WASHINGTON, Sept. 7—Figures issued to-day by the Bureau of Foreign and Domestic Commerce deal with the exports of various oils and gasoline for the month of July and also for the seven months ending with July of 1918 and 1917.

On a seven months' basis substantial gains are shown in crude mineral oil, gasoline and naphtha and residuum and fuel oil. Both illuminating and lubricating oil show a decrease. Taking the seven months of 1917 against a similar period in 1918 the latter year shows a total gain of $60,926,383 in value of exports of this class and 120,697,443 gal. in quantity. The remarkable gain in fuel oil may be accounted for by the increasing needs of oil-burning naval and merchant vessels.

Navy Airplane Base at Galveston

Mammoth Plant to Cost $3,000,000 and House 1200 Men —Nine Hangars Planned

GALVESTON, Sept. 10—As a result of a revision of the plans of the Navy Department for the construction of a naval air station here the total cost of the improvements will be more than three million dollars, or nearly double the original estimate. The proposed plant will consist of nine large hangars, repairshops, officers' and student aviators' quarters, barracks and medical quarters, for the accommodation of approximately 1200 men. Of this number about 1000 will be ground men and mechanics, 100 officers and 150 student aviators.

Each of the nine hangars will be 104 x 105, and will accommodate four machines. The first plans considered by the Navy Department called for six hangars and twenty-four sea-planes.

The site is 60 acres, between the railroad tracks leading out of the city and the bay. Three hundred and fifty thousand yards of dredging will be required for the work. Around the front and two sides of the 5-ft. elevation will be built a wooden bulkhead and an earthen levee around the back or south end. From 4800 to 4900 lineal feet of bulkheading, or filling material, will be required for filling in the dredged-in portion of the property. The basin will be dredged to a depth of 5 ft. the entire length of the building for a take-off, which will be 200 ft. in length. Construction will begin immediately.

More Money for Continental Parts

KNIGHTSTOWN, IND., Sept. 6—Continental Auto Parts Co. has increased its capital stock from $10,000 to $50,000, and is now making extensive additions to its plant and installing additional machinery and equipment in order to take care of its Government contracts. The company manufactures a line of shop and factory equipment.

Comparative Exports of Gasoline and Oil for 1917-1918

	JULY				SEVEN MONTHS ENDING JULY			
	1918		1917		1918		1917	
	Gals.	Value	Gals.	Value	Gals.	Value	Gals.	Value
Crude mineral oil	20,027,967	$1,263,926	6,291,853	$413,952	122,996,597	$6,906,301	96,312,004	$4,435,660
Illuminating oil	31,923,154	3,685,582	28,446,670	2,561,655	284,853,931	28,129,970	411,316,265	28,697,871
Lubricating oil	19,845,998	6,149,031	17,442,864	3,298,593	147,949,076	40,854,295	156,309,835	29,406,604
Gasoline, naphtha, etc	47,720,802	11,943,248	22,076,243	4,801,724	321,676,878	79,847,476	242,001,564	51,458,110
Residuum, fuel oil, etc	119,260,316	6,588,551	69,741,043	2,979,606	713,266,308	38,812,510	564,105,679	19,625,924
	238,778,237	$29,630,338	143,998,673	$14,055,530	1,590,742,790	$194,550,552	1,470,045,347	$133,624,169

Résumé of Allied Airplane Bombing

British Ministry Reports Remarkably High Avérage of Enemy Machines Downed Each Week—Ineffectual German Retaliatory Measures

WASHINGTON, Sept. 10—Little detailed information regarding the amount of air bombing now being carried on by the Allies has heretofore penetrated to this country, though intensive air bombing is constantly increasing and few German cities within a radius of 250 miles of the airplane bases have escaped. Consequently the following résumé of operations during a recent week by the British Royal Air Forces is particularly interesting and illustrative of the enemy's air losses and the numerous raids which are being carried on daily. Following is the complete résumé issued by the British Air Ministry:

Those who follow closely the news of the war in the air have been impressed by two things:

The first is the consistent and remarkably high average of enemy machines destroyed week by week. The second is the singularly spasmodic and obviously nervous way in which Germany seeks to carry the three-fold British aerial offensive which is being sustained against her.

Enemy's Heavy Air Losses

Taking the figures for the past week for example, 70 enemy machines have been destroyed and 11 driven down out of control by British airmen on the Western front alone. During the same period 27 British machines were reported missing; thus, for every British airplane which failed to return to its base, more than two German machines are known to have been smashed.

That these figures are by no means exceptional is shown by the fact that during the last four weeks 324 enemy machines have been accounted for under similar circumstances, while only 116 British have been reported missing.

The same broad results are observed upon the Italian, Balkan and Palestine fronts, where 18 enemy machines have been destroyed or driven down out of control. During the last week 12 British machines have been reported missing. Taking the whole of the European Mediterranean battlefields together, the Royal Air Force has accounted for in the neighborhood of 120 enemy aircraft against a net less of 29 British machines.

Britain's Triple Air Offensive

It is, however, upon the Western front that this remarkable disparity is most significant, for it is here that Germany is concentrating the major portion of her strength. It is here also that she is faced with the three-fold problem, not only of defending her long battle front, but also of warding off the insistent and formidable British attacks upon her right and left flanks—Belgian naval bases—and the industrial centers on the Rhine.

A Week of British Air Raids

Some idea of the scale of Britain's effort in this quarter can be gained from the following list of successful bombing raids undertaken by the Royal Air Force on the Western front during the past week:

Raids Into German Territory	No. of Raids
Offenburg	3
Stuttgart	2
Saarbrucken	2
Barden	2
Coblentz	2
Hagenau	1
Nahr	1
Rastatt	1
Sollingen	1
Pforzhein	1
Dürren	1
Traves	1

Raids Into Belgium	No. of Raids
Ostend Docks	4
Bruges Docks	3
Zeebrugger Docks	2
Westende	2
Nieuport-Ostend Canal	1
Nieuport-Bruges Canal	1
Middlekerke	1
Aerodromes and dumps	4

Innumerable raids have been made on all fatal enemy positions, including Seclin, Lille, Menin, Cambrai, Balenciennes, Cortrai, Armentieres, Douai, Bapaume, Chaulnes, Peronne, etc.

Intense Local Air Fighting

The highly damaging results to the enemy of these incessant raids is strikingly shown, not only by the photographic records by our pilots, but by the spasmodic attempts of the enemy to frustrate them.

By withdrawing urgently needed machines from other fatal points, he has occasionally been able to secure a local numerical superiority, as was the case last week at Mannheim, where, in the course of an early morning raid, we lost seven machines after "bitter fighting." This fact, however, did not prevent the Royal Air Force from renewing their attacks on Mannheim the evening of the very same day when, despite an even greater resistance than they encountered in the morning, double the number of bombs were dropped, and all our machines succeeded in returning.

Hardly less significant to Germany is the skill with which the bombing of these towns is being carried out. The courage and ambition of the average German aerial bomber does not seem to carry him beyond the perfectly promiscuous bombing of towns, except perhaps when he locates a big American or English hospital far from the battle line, then he will descend from his safe height, and having bombed the building, will adventurously expose himself to a chance rifle or revolver bullet, while machine gunning the doctors, nurses and orderlies as they are trying to carry their patients into shelter.

The Royal Air Force is singularly different in its tactics, and confines itself to important and legitimate military objectives, invariably descending low enough to make a certainty of inflicting genuine military damage. For example, to take at hazard a specimen page of R. A. F. aerial photographs we find the indisputable camera record of the following bomb bursts:

OBENDORF—3 bursts, one on the railway sidings, one alongside the extensions of the Stauser Works, one on the Mauser Works.

OFFENBURG—3 bursts, two beside the railway work shops, one on station.

OFFENBURG (following day)—5 bursts, one on main station, two on railway, one direct hit on railway bridge, one on railway south of the station.

Facts such as these go far to explain the intense resentment which Germany feels with regard to the now incessant attacks upon her centers of munitions production, attacks which not only cause her grave military damage and delay, but compel her to detach a large and growing number of machines for the defense of the threatened centers.

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Growth of Cleveland Plants

CLEVELAND, Sept. 10—As an indication of the continued development of the automobile and allied industry in this section, building permits issued in Cleveland during 1917 offer interesting figures. The following are some of the important permits granted to concerns manufacturing automobile products:

Cleveland Welding & Mfg. Co.	$60,000
Cleveland Welding & Mfg. Co.	40,000
Warner & Swasey Co.	60,000
American Steel & Wire Co.	25,000
Park Drop Forge Co.	60,000
Park Drop Forge Co.	36,000
Grant Motor Car Corp.	65,000
U. S. Tool Co.	25,000
Lang Body Co.	75,000
Parrish & Bingham Co.	80,000
Hydraulic Pressed Steel Co.	30,000
Hydraulic Pressed Steel Co.	300,000

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Work of Highways Transport Committee

WASHINGTON, Sept. 10—The work of the Highways Transport Committee, Council of National Defense, this committee having been appointed to make the most effective use possible of the highways as one of the means of strengthening the nation's transportation resources, is now being developed in such a way as to take in every state in the Union. Further, through the medium of State Highways Transport bodies, functioning with the national body, this organization is being developed in some states not only down to the districts but to the counties and even communities.

The State Highways Transport bodies are a part of the State Council of Defense. They consist of the following:

The chairman of the State Highways Transport Committee, five members of the Highways Transport body and a secretary.

The five members in question are named to represent areas of varying sizes and populations, each of the five mem-

bers being chosen from one of such five different areas, and in turn serving as chairman of his district committee. The district boundaries are laid out in harmony with existing conditions, the aim being that the most effective results possible may be brought about. For instance, in one locality large population centers may be found to be best as the heart of one or more districts. Again, in other sections, where cities of large population are not found, the district boundaries may be made to embrace agriculture, lumber, oil or other areas.

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Milwaukee-Chicago Motor Truck Line

MILWAUKEE, WIS., Sept. 10—The first regular freight service by motor truck to be established between Milwaukee and Chicago was opened during the past week by the Motor Transportation Co. of Milwaukee, organized with a capital stock of $100,000 by Milwaukee capital and Charles C. Newburn, of Chicago. Four trucks, each of 3-ton capacity, are now being operated over the 90-mile route. Besides the terminal offices in Milwaukee and Chicago, the company will maintain stations at South Milwaukee, Racine, Kenosha and Waukegan for the handling of freight. The Milwaukee interests in the new company are represented by Charles A. Robinson and George D. Persons, formerly passenger engineers on the Milwaukee road. During the first few days of the operation of the new service no difficulty has been encountered in getting capacity loads, going and returning. In fact, much more freight has been offered than can be carried with the present equipment of four trucks, and the promoters expect to add as many more within a short time.

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Carload of Fordsons Sent to Mexico

DEARBORN, MICH., Sept. 10—Henry Ford & Son received a visit last week from Randolph Robertson, vice-consul of the United States, who came from Monterey, Mexico, to make arrangements with the plant to have a carload of tractors sent down to that country. This carload, with the two tractors sent recently to President Carranza, makes a total of nine Fordsons that will soon be doing work on Mexican soil.

Two expert men are being sent to Mexico to give demonstrations with a view of educating the natives in modern methods of agriculture. The carload of tractors has been sold to Mexico at the fixed factory price, viz., $750.

Owing to the shortage of pig iron and chrome nickel steel, the production of the plant has dropped slightly during the last week. Only 803 machines were produced as against 919 the week previous. The average daily production now is 125 to 130.

Plans for the new plant at Hamilton, Ohio, have been drawn and are now awaiting the O.K. of C. E. Sorenson, manager of the company, who will soon go to that town to start building activities.

Flying "Stunts" Are Vitally Important

Essential That Military Aviators Be Taught Every Trick of the Trade—Successful Flier Must Be Able to Surpass Opponent in Skill

WASHINGTON, Sept. 10—Flying stunts are vitally important if the flier is to be victorious in combat with the enemy, according to statements made here by British air authorities. The lives that are lost in teaching stunts in training are but few in comparison to those that would be lost if the fliers were sent against the Boche without stunt practice.

"Not every one realizes," say the British authorities, "what a long time it takes to make a service flier. The average period from the time the pupil is brought to the Cadet Schools of the Royal Air Force to the time he is ready to go overseas and fly over the lines is about 7 months; yet the actual training in flying is one of the simplest items.

"The principal factor to consider in teaching flying in war time is whether it is worth while to spend the necessary time on a pupil.

"If a country is at peace, and there are plenty of machines available, it may pay to stick to a man who will undoubtedly make a flier sooner or later, for any one can fly if sufficient time be given to his instruction. But in times of war, as at the present time, when we have neither a surplus of machines available for flying nor the extra time to spend in training, it is not a practical thing to do.

Specialized Training Essential

"The hard specialized training which every one has to come to sooner or later is not only important, it is absolutely essential.

"Much has been said about 'dangerous stunts,' with the implication that these are spectacular performances which thrill the spectators but are needlessly risky, and I think this needs a little explanation.

"It is quite true that some lives were lost in the earlier days in instructing pupils in what we call 'stunting,' but it is quite useless to send a man overseas if he is unable to 'stunt.'

"In individual fighting, unless the flier can really do things better than the German, he is not going to come out alive, and it is no earthly use imagining that when the crucial moment arrives stunting is going to come naturally. For instance, when one machine meets another, each speeds up and goes through every kind of maneuver to get into a good position so as to be able to 'get' his opponent. The man who is going to come out alive is the man who can outdo his opponent in flying. It is not a question of 'getting away from the German.' It is not a matter of getting away at all, but of getting into a good position so that you can down him.

"He is going to do the same thing, and unless you are able to outdo him in his maneuver you are going to come out beaten; and unless you are trained to do real stunts (which are really not at all dangerous) you are not going to be able to down him. The danger is not in 'stunting,' but in not being able to 'stunt.'

"If a flier goes overseas, and is not able to do these things, then his life is not worth a cent. If he can do these things, and the time comes when he is absolutely face to face with his opponent, the man who will kill his opponent is the one who can throw his machine about the most and get out of a difficult position. Getting out of the difficult position saves his life, but this is not all; the real problem is to get into a good position so that he can down the enemy, and the downing of the Boche is the thing that every flier is out for. He is not there to get away, he is there to kill his opponent.

Flier Must Be Properly Trained

"To succeed, the flier must be taught properly. It may cost one or two lives this side of the water, but if the men are taught thoroughly it will mean the ending of these casualties on the other side, and the causing of many more to the enemy.

"What is more, if the pilot does not know how to 'stunt,' it will not only mean the death of the pilot himself, which is relatively not so important in view of the fact that so many thousands of men have been killed in the war, but it may result disastrously to a great number of men on the ground. When the man in the air goes down, there may be batteries dependent upon him for spotting our own fire and the enemy's artillery; there may be infantry regiments waiting to know where the Germans are, and there may be whole divisions waiting for certain information.

"It is thus absolutely criminal to send a pilot to the front who does not know how to fly, and the only way to make him capable is to teach him to 'stunt.'"

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Willys-Overland to Have Barracks

TOLEDO, OHIO, Sept. 10—The government is preparing to handle the labor supply for munition manufacture in the Willys-Overland plant. Plans have been completed for the first unit of a cantonment to house laborers, just north of the factory. The buildings will be similar to those at the army cantonments. The first one will furnish temporary sleeping quarters for 200 and will contain a mess hall.

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Lober Radiator Enlarges Capacity

TOLEDO, Sept. 7—The Lober Art Brass & Specialty Co. has leased adjoining rooms and will double the floor space and capacity of its plant. New equipment is being installed.

Passenger Car Prices Going Up

Eight Makers Boost Lists Substantially—Truck Prices, Too, Advanced

DETROIT, Sept. 5—The Willys-Overland Co., Toledo, has increased the prices of all its models, effective Sept. 1, as follows:

Model	Old Price	New Price
90 (T) Touring	$895	$1095
90 (R) Roadster	895	1095
90 Country Club	925	1145
90 Sedan	1385	1665
90 Panel Delivery	875	1045
90 Express Delivery	875	1025
1200-lb. Express Delivery	1075	1150
1200-lb. Spec. Open Panel Delivery, right-hand drive	1075	1150
85-4 Touring	1025	1175
85-4 Roadster	1025	1175
85-6 Touring	1300	1495
85-6 Roadster	1300	1495
85-6 Coupe	1550	1750
85-6 Sedan	1720	1920
89-6 Touring	1525	1775
89-6 Club Roadster	1525	1775
84-4 Touring	1650	1925
88-4 Coupe	2600	2850
88-4 Sedan	2650	2950
88-8 Touring	2500	2750
88-8 Coupe	3175	3425
88-8 Sedan	3200	3475
88-8 Limousine	3300	3500

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Cadillac Prices Increase

DETROIT, Sept. 5—The Cadillac Motor Car Co. has advanced its prices $300 on the following models, effective Sept. 1:

Model	New Price	Old Price
Touring Car	$3520	$3220
Phaeton	3520	3220
Roadster	3520	3220
Brougham	4390	4090
Suburban	4640	4340
Limousine	4695	4395
Landaulet	4795	4495
Town Limousine	4660	4330
Town Landaulet	4810	4510

F. O. B. Detroit, not including war tax.

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Nash Prices Go Up

KENOSHA, WIS., Sept. 10—The Nash Motors Co. increased the price of its cars and trucks on Sept. 1 as follows:

	New Price	Old Price
5-pass. touring	$1490	$1395
7-pass. touring	1640	1545
4-pass. roadster	1490	1395
6-pass. sedan	2250	2085
4-pass. coupe	2250	2085
1-ton chassis	1650	1595
2-ton chassis	2175	2075

—

Kissel Prices Revised

HARTFORD, WIS., Sept. 10—The Kissel Motor Car Co. has increased the price of its cars and trucks as follows:

	New Price	Old Price
4-pass. roadster	$1743	$1645
4-pass. sedan	2293	....
5-pass. touring	1743	1645
5-pass. sedan	2293	....
Trucks		
General Utility, 2-ton	$2073	$1885
Freighter, 2½-ton	2832	2575
Heavy Duty, 4¼-ton	3905	3550
Dreadnaught, 6-ton	4785	4350

—

Jones Car Prices Advanced

WICHITA, Sept. 7—The Jones Motor Car Co. has advanced its prices as from Sept. 1 as follows:

	New Price	Old Price
27-B 7-pass.	$2100	$1875
Sport, 4-pass.	2350	....

Several minor refinements have been incorporated in the 7-passenger model and the 4-passenger sport model is fitted with wire wheels, 32 x 4½ in. cord tires and paint and upholstery colors are optional.

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Hupp Prices Advance

DETROIT, Sept. 10—The new price of both the Hupmobile touring car and roadster is $1,500 instead of $1,350. This advance was effective Sept. 1.

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Packard Prices Increase $500

DETROIT, Sept. 10—The Packard Motor Car Co. has advanced its prices, effective Aug. 26, as follows:

Model	New Price	Old Price
3-25 Touring	$4,800	$4,300
3-25 Limousine	6,350	5,850
3-25 Brougham	6,500	6,000
3-25 Coupe	6,150	5,650
3-35 Touring	5,150	4,650
3-35 Limousine	6,700	6,200

—

Hudson Super-Six's Advance $250

DETROIT, Sept. 10—The Hudson Motor Car Co. has advanced the prices of the Super-Six models, $250, effective Sept. 1, as follows:

Model	New Price	Old Price
Seven-pass. Phaeton	$2,200	$1,950
Four-pass. Phaeton	2,300	2,050
Sedan	3,000	2,750
Runabout Landau	2,690	2,440
Limousine	3,650	3,400
Town Car	3,650	3,400
Coupe	3,100	2,850
Town Limousine	3,400	3,150

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Motor Transport Corps to Consist of 154,774 Men

(*Continued from page* 470)

Transport Corps is operating 1500 trucks in convoy trains in this country exclusive of the trucks used at the various army posts. These 1500 trucks carry various kinds of merchandise and munitions for the army over an average of 100,000 miles every 24 hr. The Motor Transport Corps is desirous of securing a great number of men and officers, men especially qualified to drive motor vehicles by the thousand, and executives with business experience are wanted for officers. Men in the deferred classes of the first draft will be inducted into this service. Further information can be secured by addressing the chief of the Motor Transport Corps, Washington, D. C.

There is quite a difference of opinion here as regards the re-establishment of the original A and AA standard trucks in the army program. Members of the Motor Transport Corps state that it is most improbable, while on the other hand several consider it a possibility. It is also stated by members of the Purchasing Section that the report of contracts placed for 17,000 A trucks, which was given out by an officer of the Motor Transport Corps, is incorrect and that only a small part of this business has been confirmed.

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To Enlarge Selfridge Field

WASHINGTON, Sept. 10—Eighteen hundred acres of land adjoining Selfridge Field, Mt. Clemens, Mich., have been acquired and will be added to the field for aviation instruction purposes.

Industries Must Use More Women

H. E. Miles Says 500,000 More Skilled Workers Will Be Needed in 90 Days

CHICAGO, Sept. 10—American industry is not as yet at war and it is time that it were. It does not realize that 2,000,000 men will be taken from the industries of the United States within a few months, and that it will take 12,000,000 people to produce what these 2,000,000 consume. This is the way in which H. E. Miles, chairman Section on Industrial Training for the War Emergency Advisory Commission, Council of National Defense, aroused the Employment Managers' Association of Chicago at its dinner last night.

Mr. Miles' work is seeing that training courses for unskilled labor are installed in industries. His plan, which is the plan of the Government, is to install practical training courses in the larger factories for the development of semi-skilled employees.

In emphasizing the need for skilled labor, Mr. Miles said that within 90 days over 500,000 new skilled laborers will be needed for manufacturing operations. This is more than the total of skilled mechanics in the whole country in 1910. The production of our factories must be doubled. So imperative is the need that Mr. Miles asked in the name of the Government that the Chicago employers act to-morrow in the establishment of these schools. In illustrating what could be done the speaker told of the results of similar schools in England, and stated that European factories are getting out a much greater per capita production since the war and a 25 per cent increase in per capita production is expected in America.

England's original method at the beginning of the war consisted of taking 60 schools from which they discharged the teachers and installed shop foremen, etc., as instructors. By this means, however, they got only two thousand new skilled laborers a month. They undertook to train thousands of women not only in the schools but in the factories themselves in separate instruction bays. English employers set up human toolrooms in each factory. France is doing the same thing and requires every plant employing 300 people or more to put in training schools. In England it is made as a part of the ordnance contract.

Mr. Miles insists that American plants must use more women and must depend on women chiefly for their skilled labor.

"Sex has nothing to do with machine production," said Mr. Miles. He stated that there is nothing on an airplane that women are not doing in England. The Curtiss company here is training women for skilled operation in four days. The Wolwich Arsenal in England has 40,000 women in it.

The best method of training, said Mr. Miles, is to take men from the factory

who can tell what they know, send them to schools and make them high class instructors, then send the women, old men and boys for a short period of intensive training on some particular job.

As a rule these schools are not an operating expense, as the material they turn out is production material, and the rate of pay during training is low enough so that the unit cost is not higher than that of the regular production part of the plant. Some of the plants in this country pay 20 to 30 cents an hour while training on work that pays 45 cents an hour in production.

E. A. Russell, chief ordnance inspector, added that with 4,000,000 men on the other side next year the army program would call for $14,000,000,000 worth of material. He said that the shells already contracted for in America if placed end to end would reach around the earth at the equator and then overlap for 5000 miles.

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Passenger Car Pledge

WASHINGTON, Sept. 10—No special priority class rating has been assigned to the passenger car industry and it will be necessary for each manufacturer to make application for the steel he requires. The preference in priority will be graded, possibly, by the class of steel required. A "passenger automobile manufacturer's pledge" has been approved by the War Industries Board and must be filled in by every manufacturer who desires to secure steel and filed with the Automotive Section of the Board. After the pledges have been signed and sent in, the manufacturer may make application to the Director of Steel Supply, War Industries Board, Washington, for a permit to purchase the steel or manufactured steel products.

The manufacturer's pledge is as follows:

War Industries Board,
Washington, D. C.
Gentlemen:

Attention: Automotive Products Section

The undersigned hereby pledges itself:

(1) Not to purchase iron or steel or iron or steel parts or equipment except under permit from the Director of Steel Supply.

(2) To limit its purchase of materials, parts, equipment and supplies to an amount which does not exceed either

(a) The amount absolutely necessary to match up its stocks now on hand, or

(b) The amount necessary to permit a production of passenger automobiles and all repair parts therefor for the six months ending Dec. 31, 1918, not in excess of 25 per cent of its production for the calendar year 1917.

(3) That it will conserve and economize in every possible way its stocks of iron and steel and their products now in its hands, or that may come into its possession, and will release on request of the War Industries Board to such other manufacturer of passenger automobiles as may be designated by the said board such of its stocks as can be utilized by such other manufacturers and which are not required by it for either the limited production above specified or for war work.

(4) That it will from time to time render such reports of its activities under oath or otherwise as may be called for by the War Industries Board.

Ford Stops Building Passenger Cars

Company to Devote Entire Plant to War Work—Franklin and Hudson Quit, Too

DETROIT, Sept. 10—The Ford Motor Co. will immediately abandon the manufacture of passenger cars during the period of the war; only a limited number will be made for the use of the Government. From this time forward the entire resources of the company are to be devoted to war work. The Ford plant will be used exclusively for the production of Liberty engines, tanks, ambulances and such other work as the Government may desire.

Ford is the third manufacturer to announce a policy of 100 per cent war work. The Hudson Motor Car Co. already has let it be known that henceforth and until after the war no more Hudson cars will be produced. This week the Franklin Automobile Co., Syracuse, has made public that its plants are now practically 100 per cent on war work and that it is the intention not to produce any more Franklins until after the war.

The decision to devote the entire Ford resources to war work applies also to the 31 branch assembly plants scattered throughout the large industrial centers of the country. Six of these, located in Cambridge, Mass.; Louisville, Ky.; Philadelphia, St. Louis, Washington and Long Island City, already have been turned over entirely to the Government and the others will be turned over rapidly.

Abandonment of the manufacture of passenger cars will not affect the production of trucks and tractors. Trucks are considered essential by the War Industries Board, and their production will be continued. The Fordson tractor is produced by Henry Ford & Son in an entirely separate plant at Dearborn, Mich., and its production will be continued.

The conversion of the Ford passenger car production facilities to 100 per cent war work has not been entirely unexpected. As long ago as November there were persistent rumors that the manufacture of passenger vehicles was to be eliminated. These, however, were denied at that time.

Immediately following the denial of these rumors, announcement was made from the Ford plant that the top notch in production had been reached, the factory having turned out a total of 3000 cars on Nov. 23.

This production was maintained practically constant until early in February when it was cut down 50 per cent and remained practically constant until nearly the end of June. At that time the production had been further reduced to 750 cars a day.

Beginning Aug. 1 production was further reduced to 350 passenger cars a day. The production of trucks has been steadily increasing, until at the present time approximately 400 are being turned out daily.

During the fiscal year ending July 31 last the production of the Ford Motor Co. totalled approximately 700,000 cars as compared with 785,000 during the last year. On June 10 there were unfilled orders on hand for more than 110,000 cars.

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Owen Develops Farm Light System

NEW YORK, Sept. 10—A farm lighting system completely automatic in operation has been placed on the market by R. M. Owen & Co., 1765 Broadway, New York. It comprises a single cylinder 3 x 4-in. water-cooled vertical engine direct-connected to a four-pole generator of 1250 watts output. Engine speed is controlled by a centrifugal governor acting on the throttle valve, and a constant voltage is maintained by the use of compound field windings.

Included in the outfit is a 16-cell, 80-ampere-hour Willard battery in glass jars. The outfit is started by pushing a button switch and stopped by pushing similar switch. When once started the engine runs until the battery is full, when it is automatically shut off. When the battery has been discharged to a certain predetermined state the engine is automatically started.

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Packard 100 Per Cent On War Work

DETROIT, Sept. 12—Packard starts Thursday 100 per cent on war work. Packard will confine its efforts to the production of Liberty engines, of which it is now making about 35 daily, airplane bodies, war tractors and trucks.

There are several airplane body models one of which is an entirely new one the French Commission is working on. There have been some completed which are now in use in tests at Dayton and elsewhere.

Sensing the placing of an order for Liberty engines from the government the company stimulate the production of Twin Six power plants and was fortunate in producing 6000 before the first order for 600 Liberty engines was placed. The production of trucks includes all war models and those for commercial use which are intended for essential industries. The truck production schedule provides for 8000 to 10,000 vehicles for the fiscal year ending Sept., 1919. Fully one hundred million dollars worth of war work will have been completed during the coming year.

Twelve thousand men and women are employed by the company in the sixty-one buildings which cover fifty-six acres of ground.

During the suspension of car manufacture the company will endeavor to maintain service on all trucks and the forty-five thousand passenger cars that are now running.

The company has affiliated with it 110 dealers who will be affected by the new arrangement; many of these have increased their stocks of accessories. Those who are handling trucks will be permitted to continue, provided they sell the vehicles to essential industries.

Horowitz in Charge of Tanks

WASHINGTON, Sept. 6 — Louis J. Horowitz, formerly president of the Thompson Starrett Construction Co., New York, has been appointed assistant chief of ordnance, in charge of tanks. Mr. Horowitz will have complete authority on the engineering, manufacturing and inspection of tanks.

Brig.-Gen. J. T. Thompson, U. S. A., retired, has been made director of ordnance training, and will work out the types of training to be given the personnel of the Ordnance Department, and will make provisions for this training. Capt. S. E. Blunt has been appointed employment supervisor in charge of the personnel employment bureaus of the several arsenals and other ordnance establishments.

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H. E. Henry has been appointed general sales manager of the Fulflo Pump Co., Blanchester, Ohio, succeeding A. N. Martin, who has accepted a position with the Pyle National Co., Chicago.

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Thos. J. Litle, Jr., engineer of the Lincoln Motor Co., Detroit, has been appointed a member of the welding research committee of the Emergency Fleet Corp., United States Shipping Board.

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W. G. Bell, for the past 4 years assistant sales manager in the Dominion of Canda for the Studebaker Corp., has been appointed Canadian sales manager of the Cleveland Tractor Co., Cleveland.

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William B. Stout has resigned his position as technical adviser to the Aircraft Board at Washington and has returned to Detroit to take up the manufacture of a plane of his own design. The experimental work and preliminary construction is being carried out by W. C. Rands, of the Rands Mfg. Co., Detroit.

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J. H. Fenton of the Los Angeles office, of the Westinghouse Electric & Mfg. Co. has recently been appointed manager of the Industrial Division of that office, which includes jurisdiction over the Tucson and El Paso offices.

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J. N. Mahoney, for 12 years a member of the Engineering Department, has tendered his resignation from the Westinghouse Electric & Mfg. Co. to open consulting offices in New York.

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B. F. Page, formerly eastern representative of the Four Wheel Drive Auto Co., Clintonville, Wis., has been appointed assistant to L. P. Fortin, acting manager of the Oneida Motor Truck Co., Green Bay, Wis.

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E. J. Wright, formerly with the Allen Motor Car Co. has been appointed assistant to the sales manager of the Dort Motor Car Co., Flint.

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Ralph J. Handy, former distributer of the Tonford truck attachments in Detroit, has become sales manager of the Lauton Truck Co., Youngstown, Ohio.

Men of the Industry

Changes in Personnel and Position

John Squires has resigned as general manager and chief engineer of the Signal Motor Truck Co., Detroit, his duties as manager being taken up by F. W. Henderson, and those of chief engineer by S. Deutsch. Mr. Squires will shortly announce his plans for the future.

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W. C. Anderson, manager of the Ford Motor Co. assembling plant at St. Louis, has been transferred to Chicago following the turning over of the St. Louis building to the quartermaster's department of the United States Army. He will have charge of assembling plant in Chicago for the present.

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Charles E. Becker, formerly advertising manager of the Jones Motor Car Co., Wichita, Kan., has been called to the colors.

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A. B. Jones, second vice-president of the B. F. Goodrich Co., Akron, has been appointed by the American Red Cross to the post of director of transportation and distribution of Red Cross supplies in France.

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Frank M. Eldredge, Detroit, has assumed entire charge of the sales and advertising departments for L. V. Flechter & Co., New York. He has been handling all the national advertising for the company for the past year and will now add the sales to his other duties. He will continue his publicity and sales promotion bureau.

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C. W. Whitson, formerly with the Fulton Motor Truck, Farmington, Long Island, and who recently resigned from that organization, has been appointed general sales manager of the Panhard Motors Corp., Grand Haven, Mich.

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A. W. Redlin, for the past 2 years division superintendent of the Mitchell Motors Co., Racine, has been appointed assistant works manager of the Erd Motor Co., Saginaw.

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L. F. Collins has been appointed truck sales manager of the Nash Motors Co. This position was left vacant by H. C. Hart, who recently received a captain's commission in the Ordnance Department of the United States Army.

More Money for Kelly Men

CLEVELAND, Sept. 9—The Kelly Resmer Co. has voluntarily increased the wages of its employees ten per cent beginning August 24. The increase was unsolicited.

Appoint Fordson Export Distributer

DEARBORN, MICH., Sept. 6—Henry Ford & Son, Inc., have appointed Sherman & Sheppard as export distributers of Fordson tractors. This firm has a New York office and will also have one in Buenos Aires.

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Urge Bankhead National Highway

WASHINGTON, Sept. 10—Delegations representing chambers of commerce from Richmond, Va.; Atlanta, Ga.; Memphis, Tenn.; Dallas, Tex.; Oklahoma City and other southern and western cities will meet in Washington Dec. 10 to urge upon Congress the necessity of the Bankhead National Highway from Washington to Los Angeles. The meeting will probably be in the form of a joint hearing with Senators and Congressmen, and the establishment of the road will be urged as a war measure. It was pointed out that the highway traverses 22 cantonments, aviation and military posts.

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Anthracite Production Gains Slightly

WASHINGTON, Sept. 10—Bituminous coal production for the week ended Aug. 31 was 12,642,000 tons, approximately the same as the preceding week. Anthracite production for the week was 2,259,716 tons, an increase of 125,716 tons or 5.9 per cent over the preceding week.

During the week of Aug. 24 the bituminous mines operated 81.5 per cent of their full time output. Production losses were due to car shortage, 9.9 per cent; labor shortage, 3.5 per cent; mine disability, 3.9 per cent; no market, 0.4 per cent; all other causes, 0.8 per cent.

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254,722 Cars in Michigan

LANSING, Sept. 9—On Sept. 1, 1918, there were 254,722 automobiles in the State of Michigan, according to the Secretary of State. The registration records also show that of the 254,722, 229,762 were passenger cars and 24,960 were commercial vehicles. The number of motorcycles registered was 7452 and there were also 22,648 chauffeurs on Sept. 1. The total fees collected up to Sept. 1 is $2,840,995.35.

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Chicago Pneumatic Enlarges

CLEVELAND, Sept. 9—The Chicago Pneumatic Tool Co., Chicago, will erect a $150,000 addition to its plant, in order to double its present capacity. Work on the building will be completed about Nov. 1.

The Cleveland Twist Drill Co. will also erect a $120,000 addition to its factory.

—

Car Makers Want Tools

DETROIT, Sept. 9—The Maxwell Motors Corp. is inquiring for a large number of tools for shell-making. The Winton Motor Car Co., Cleveland, is in the market for screw and milling machines as well as drill presses. It recently obtained a large order for tripods for Browning machine guns.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Electric Steel Absorbs Crucible

CLEVELAND, Sept. 7—The Electric Steel & Forge Co. has absorbed the Crucible Steel Forge Co. of this city and will continue and expand this business. For this purpose it will purchase adjoining land on which to erect suitable buildings, install two electric furnace units, heat-treating furnaces, rolling mills, machineshop and other necessary equipment. It will have a production capacity of 9000 to 10,000 tons per annum of tool steel and alloy steel, and a rolling and forging capacity in excess of this tonnage.

The products of the company will include carbon and tungsten tool steel, nickel, vanadium, chrome, chrome-vanadium, chrome-nickel, silicon-manganese and other kinds of tool steel and special alloy steel. Among its specialties, besides billets and bars for the market, will be heat-treated piston rods, die blocks and rings, gun forgings, gun mount forgings, spindles, gear rings, blanks and shafts.

The officers of the company are: President, James H. Foster, president and general manager of the Hydraulic Pressed Steel Co.; vice-president and general manager, D. W. Wells, formerly general manager of the Crucible Steel & Forge Co.; secretary, C. R. Cross, president of the Colonial Savings & Loan Co.; treasurer, A. B. Smythe, president the A. B. Smythe Co. The board of directors is composed of the officers and the following: C. R. Hamilton, director Cleveland Brass & Copper Mills, Inc.; Hames Herron, consulting metallurgist the Cleveland Engineer Society; J. A. House; W. D. Sayle, president the Cleveland Punch & Shear Works Co.; W. H. Staring, vice-president and general manager the Peerless Motor Car Co.

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Wisconsin Schedules Tractor "Rally"

MILWAUKEE, Sept. 9—The Wisconsin Power Farming Association, organized recently at Milwaukee by manufacturers and distributers of farm tractors and power farm machinery, will hold a "tractor rally" at the Republican House, Milwaukee, on Friday evening, Sept. 13, to acquaint dealers and owners of such equipment with its plans to guarantee every owner proper service after he has been sold. The meeting is held at this time to take advantage of the presence of many dealers and owners attending the Wisconsin State Fair, which closes on Saturday. During the fair the association is making an energetic campaign for new members among the thirty-six tractor manufacturers represented on the grounds.

—

Northern Foundry to Double Plant

MARINETTE, WIS., Sept. 8—The Northern Foundry Co., organized early this year by Marinette, Milwaukee and Racine capital to engage in the manufacture of automotive and agricultural castings, has concluded arrangements to double the size of its plant by taking over adjoining buildings. The present force of 60 will be increased to 125 or more by the end of September. Much of the output is being taken under contract by the J. I. Case T. M. Co., Racine, Wis., maker of passenger cars, tractors and other power farm machinery. J. M. Fitzpatrick is manager of the Marinette foundry.

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Puritan Gets Alco

DETROIT, Sept. 6—The Puritan Machine Co. has completed arrangements with the American Locomotive Co. covering the purchase of the entire service repair parts business, including the existing stock of spare parts, tools, jigs, dies, blueprints, etc., covering the Alco passenger cars and trucks formerly manufactured in Providence, R. I. The service business will be continued from the Providence plant for the present.

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New Plant for Wells Mfg. Co.

FOND DU LAC, WIS., Sept. 9—The Wells Mfg. Co., Fond du Lac, Wis., manufacturing electric lighting units and other accessories for motor vehicles and similar purposes, has moved its plant into new quarters, consisting of a two-story fireproof building, 50 x 120 ft. in size, which makes available considerably more floorspace than in its former works. The company is extensively engaged in Government contracts, the nature of which is not disclosed.

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More Room for Highway Trailer

EDGERTON, WIS., Sept. 9 — The Highway Trailer Co., Edgerton, Wis., has started work on a large factory addition, 40 x 200, one and two stories high, to provide the additional facilities required to adequately handle large Government orders for trailers for hauling ordnance, munitions, aircraft, etc. About $30,000 will be invested in the improvement. James W. Menhall is general manager.

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Buick Starts on Two New Units

FLINT, Sept. 3—The Buick Motor Co. will erect two new factory buildings to aid in Liberty engine production. One is a two-story structure, 80 by 240, to cost $77,760, to take care of the overflow production of the eight-cylinder Liberty engine from Plant No. 11. The contract calls for completion by Nov. 1. The other is a two-story aluminum foundry, 120 by 300, in which will be the melting room, molding floor and core room, and a front building, 90 by 240 ft., in which the cleaning and sand-mixing rooms are to be located. The estimated cost of the latter is $163,500.

Wisconsin Duplex Becomes Oshkosh

OSHKOSH, Sept. 9—The Wisconsin Duplex Automobile Co., Oshkosh, Wis., which recently completed development work and is now engaged in a regular production of commercial chassis, has changed its corporate style to the Oshkosh Motor Truck Mfg. Co. and adopted the trade-mark of "Oshkosh" for its product. The principal object of the change is to give due recognition to the city where the truck is being made, and also to avoid confusion with existing concerns which include the word "duplex" in their corporate names. It is planned to manufacture from sixty to seventy-five trucks for delivery by Jan. 1. The first five cars of the initial commercial output will be ready during the coming week, and most of them will go to purchasers in and around Oshkosh. A sales organization is now being perfected and the company plans to undertake an extensive advertising campaign.

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New Method of Obtaining Brinell Hardness

(*Continued from page* 457)

As in the case of the standard Brinell machine, there are certain limitations to all ball hardness testers. In those cases in which the metal is extremely hard a permanent deformation of the ball results. Where the test specimen is soft, the ball penetrates so closely to the supporting surface or anvil that the hardness of the latter affects the results. Small narrow specimens of hard steel crack under test, and soft narrow ones permit of an easy lateral flow which affects the accuracy of the test. Fortunately, with the exception of thin pieces such as sheets, none of the above cases are so extremely common as to materially curtail the use of the Brinell machine. In the case of thin soft sheets, by reducing the load to 1000 kg. or by reducing the size of the ball consistent results can be obtained; with the device described it is necessary to use a smaller ball and less impact.

Two Varying Factors

In the standard Brinell machine there are only two factors which can be varied, namely, the load and the size of ball. In the device described the weight, the height and the diameter of the ball may be varied. Just what values will eventually be assigned to these factors has not as yet been determined.

In designing a machine upon the principle described, it is possible to have it either hand or power operated. The weight can be raised and tripped at as rapid a rate as the samples can be supplied and removed, so that it will work if required with the regularity of a shear or punch press. The cost of manufacture will be less than that of the standard Brinell machine, since there are fewer accurately machined parts required, and this, together with the rapidity with which tests can be made, should, in the writer's opinion, create a useful field for a device of this nature.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. ..... .02-.03
Phosphoric, ct. .... .35-.39
Sulphuric (60), lb. .009

Aluminum:
Ingot, lb. ..... .33
Sheets (18 gage or more), lb. ..... .40

Antimony, lb. ..... .13⅞-.14⅛

Burlap:
8 oz., yd..... .17½
10 oz., yd..... .23

Copper:
Elec., lb. ..... .26
Lake, lb. ..... .26

Fabric, Tire (17¼ oz.):
Sea Is., combed, lb.1.65-1.70
Egypt, combed, lb.1.25-1.35
Egypt, carded, lb..1.20-1.30
Peelers, combed, lb.1.05-1.20
Peelers, carded, lb. .95-1.05

Fibre (⅛ in. sheet base), lb ..... .50

Graphite:
Ceylon, lb. ..... .07½-.25
Madagascar, lb. .... .10 -.15
Mexican, lb. ..... .03¾

Lead, lb. ..... .08-.09

Leather:
Hides, lb. ..... .18-.35¼

Nickel, lb. ..... .40-.43

Oil:
Gasoline:
Auto., gal. ..... .24½
68 to 70 gal..... .30½
Lard:
Prime City, gal..2.30
Ex. No. 1, gal....1.60
Linseed, gal. 1.90
Menhaden (Brown) gal. 1.30-1.31
Petroleum (crude),
Kansas, bbl. 2.25
Pennsylvania, bbl. 4.00

Rubber:
Ceylon:
First latex pale crepe, lb. ..... .63
Brown, crepe, thin, clear, lb. ..... .60
Smoked, ribbed sheets, lb. ..... .61½
Para:
Up River, fine, lb. .68
Up River, coarse, lb. ..... .40
Island, fine, lb... .59
Island, coarse, lb. .27

Shellac (orange), gal. .70-.76

Spelter ..... .09¾-.09⅝

Steel:
Angle beams and channels, lb. .... .03
Automobile sheet (see sp. table).
Cold rolled, lb..... .06½
Hot rolled, lb..... .03½

Tin ..... .80

Tungsten, lb. 2.45

Waste (cotton), lb... .12¾-.17

Although showing a slight decrease during the first year of the war, the annual production has advanced steadily since

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only Per 100 lbs.	Primes when seconds up to 15 per cent are taken Per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Ch'ge Net
Ajax Rubber Co	60½	62½	—1½
J. I. Case T. M. Co., pfd	78	83½	..
Chalmers Motor Co., com	4	6	— ½
Chalmers Motor Co., pfd	20	30	..
Chandler Motor Car Co	87¾	88¼	+1¾
Chevrolet Motor Co	129	131	+2
Fisher Body Corp., com	36	37	+1
Fisher Body Corp., pfd	84	87½	—1
Fisk Rubber Co., com	60	62	..
Fisk Rubber Co., 1st pfd	97	103	—1
Fisk Rubber Co., 2nd pfd	79	83	+1
Firestone Tire & Rubber Co., com	105	107	..
Firestone Tire & Rubber Co., pfd	94	96	..
General Motors Co., com	125	128½	—7
General Motors Co., pfd	78¼	78½	+ ⅛
B. F. Goodrich Co., com	46	46½	+1¾
B. F. Goodrich Co., pfd	99½	101	+ ½
Goodyear Tire & Rubber Co., com	152	155	+2
Goodyear Tire & Rubber Co., pfd	98¼	99¼	+ ¾
Grant Motor Car Corp	2¾	3	..
Hupp Motor Car Corp., com	3	3¼	+ ⅛
Hupp Motor Car Corp., pfd	78	82	..
International Motor Co., com	31	36	+3
International Motor Co., 1st pfd	62	68	..
International Motor Co., 2nd pfd	36	41	+1
Kelly-Springfield Tire Co., com	47	47¾	— ½
Kelly-Springfield Tire Co., 1st pfd	81½	87	+ ½
Lee Rubber & Tire Corp	19½	20½	— ¼
Maxwell Motor Co., Inc., com	26⅝	27	— ⅛
Maxwell Motor Co., Inc., 1st pfd	58	59	+1¼
Maxwell Motor Co., Inc., 2nd pfd	20½	21½	+ ½
Miller Rubber Co., com	106	108	..
Miller Rubber Co., pfd	95	96	..
Packard Motor Car Co., com	118	125	..
Packard Motor Car Co., pfd	91	95	—3
Paige-Detroit Motor Car Co	16	17	—1
Peerless Truck & Motor Corp	15	16	..
Portage Rubber Co	105	109	..
Reo Motor Car Co	14½	15½	..
*Saxon Motor Car Corp	5¼	5⅞	— ¾
Standard Motor Construction Co	12½	13¼	+ ¼
Standard Parts, com	60	65	+1
*Stewart-Warner Speed. Corp	57	58	+1
*Studebaker Corp., com	46½	46⅞	+3½
*Studebaker Corp., pfd	80	90	—4
Swinehart Tire & Rubber Co	50	60	..
United Motors Corp	31¼	31½	—1¼
*U. S. Rubber Co., com	62	63	— ¼
*U. S. Rubber Co., pfd	103	104½	— ½
*White Motor Co	46	46½	+ ⅛
*Willys-Overland Co., com	20	20⅛	+ ⅛
*Willys-Overland Co., pfd	82	83	..

*At close of business, Sept. 7 Listed N. Y. Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	..	7¾	..
Bower Roller Bearing Co	16½	18¼	..
Chevrolet Motor Co	125	130	—10
Continental Motor Co., com	5⅜	5¾	..
Continental Motor Co., pfd	..	..	..
Edmund & Jones, com	..	17	..
Edmund & Jones, pfd	..	90	..
Ford Motor Co. of Canada	151	155	+2
Hall Lamp Co	..	14¼	..
Michigan Stamping Co	..	..	..
Packard Motor Car Co., com	124	126½	..
Packard Motor Car Co., pfd	91	94	..
Paige-Detroit Motor Car Co	..	17¼	..
Prudden Wheel Co	9⅛	..	..
Reo Motor Car Co	15⅛	15½	— ⅝

INACTIVE STOCKS

Atlas Drop Forge Co	..	25	..
Kelsey Wheel Co	25	..	..

Process Refining System Would Increase Gasoline Production

(*Continued from page* 447)

taken up process systems as they should. It is estimated that of the 75,000,000 barrels of crude oil which go to the refineries each year for gasoline manufacture, not over 15,000,000 barrels are distilled by process systems.

Some experts familiar with the oil refinery field declare that many of the oil refiners are narrow-minded on this process system of production and do not seem willing to take up process systems in use by other companies, which can be done on a royalty basis. Recently the Standard Oil Co. offered the Burton process free to other refineries for the period of the war but this was not attractive because it called for large installation by these refineries, which installation would be useless after the war unless under a royalty basis with the Standard Oil Co. There are, however, other processes not taken up by the large companies which have demonstrated that they are practically as efficient as those processes now in extensive use.

The Fuel Administration should give some attention to more rapid introduction of the process systems rather than focusing its attention too much on the curtailment method, which seems the only one up for consideration at present.

The necessary expenditure for installing a process system is not prohibitive; estimates made by men who have spent a lifetime in the refining field declare that it is possible to pay off the cost of the installation of a process system in 3 months. The figures they give are as follows:

It will cost from $80,000 to $120,000 to construct a process plant that will refine 1000 bbl. per day.

The profits that will come from this process plant as compared with the skimming plant are estimated as follows by these experts:

By the skimming method the refinery earns on an average of 60 cents per bbl. Sometimes the profit is as low as 35 cents and at other times it rises to 75 cents.

By installing a process system these profits are increased from 60 cents to $1.75 per bbl., or a profit of approximately $1.15 per bbl. additional by the process system.

Estimating roughly on an added profit of $1 per barrel, the process system installation which will handle 1000 bbl. per day would give an added profit of $1,000 per day, and in 80 days would show a profit equal to the cost of installing the best systems.

Under the skimming system of gasoline refining a barrel of crude oil which reaches the refinery is broken up approximately as follows:

Gasoline	25 per cent
Light oil	8 per cent
Fuel oil	67 per cent

Under the process system the refining of this same gallon of crude will yield as follows:

Gasoline	50 per cent
Fuel oil	47 per cent
Losses	3 per cent

In view of these figures it would seem of importance that steps be taken to conserve our supply of crude oil and incidentally our supply of gasoline by insisting upon process installation. In the present war this seems just as important as conserving our food supply by calling for various mixtures of grains as suggested by the Food Administrator. The advice of the Food Administrator has not been to curtail except beneficial to the human being but rather eat according to the suggested combinations of food.

Preference List of 74 Industries

(*Continued from page* 471)

cipally in rolling and drawing copper, brass and other copper alloys in sheets, rods, wires and tubes)	II
Chain (plants making principally iron and steel chains)	III
Chemicals (plants making same for aircraft and war needs)	I
Chemicals (other chemical plants)	IV
Coke (plants engaged in producing metallurgical coke and by-products, including toluol)	I
Electrical equipment (plants engaged principally in manufacturing same)	III
Farm implements (plants engaged principally in manufacturing farm operating equipment and agricultural implements)	IV
Ferro-alloys (plants engaged principally in producing ferro-chrome, ferro-manganese, ferro-molybdenum, ferro-silicon, ferro-tungsten, ferro-uraniam, ferro-vanadium and ferro-ziconium	II
Machine tools (plants principally making same)	II
Mines (coal)	I
Mines (producing metals and ferro-alloy minerals)	II
Mines (plants making principally mine tools and equipment)	III
Oil and gas (plants engaged principally in producing oil and natural gas for fuel or for mechanical purposes, including refining or manufacturing oil for fuel or mechanical purposes)	I
Oil and gas (pipe lines and pumping stations engaged in transporting oil and natural gas)	I
Oil and gas (plants engaged principally in manufacturing equipment or supplies for producing or transporting oil or natural gas or for refining and manufacturing oil for fuel or mechanical purposes)	III
Steel making furnaces (plants engaged solely in manufacturing ingots and steel castings by the open hearth, Bessemer, crucible or electric furnace processes, including blooming mills, billet mills and slabbing mills for same)	I
Steel (plate mills)	I
Steel (all plants operating steel rolling and drawing mills exclusive of those taking higher classification)	III
Tanners and tanning (all plants engaged principally in tanning leather or in manufacturing tanning extracts)	IV
Textiles (plants engaged principally in making textile machinery, cotton or woolen textiles, or cotton or woolen knit goods)	IV
Tools (plants engaged principally in making small or hand tools for working wood or metal)	III
Tin plates (plants engaged principally in manufacturing same)	III

The term "principally engaged in" means 75 per cent of the product mentioned. In other words a concern must devote at least 75 per cent of its resources to the manufacture of the product specified to secure preference.

This list, compiled by the Priorities Division of the War Industries Board, in co-operation with the Railroad Administration, U. S. Shipping Board, War Trade Board, Food Administration, Fuel Administration, War Department, Navy Department, Allied Purchasing Commission and War Labor Policies Board, supersedes all previous lists. It was created by weighing the:

(a) Intrinsic importance of the product during the war.
(b) The need for maintaining or stimulating the production.
(c) The proportion of the industry or plant devoted to war work.

Requirements of the industries named will have precedence over those industries not included in the list. There will be no complete or absolute preference between the four classes, the division being chiefly for the purpose of presenting a composite picture of the relative importance of each industry or plant embraced in each group. It is not intended that the requirements for example of class II will be fully satisfied before the needs of class III or class IV are met.

After the list of individual plants is made public each plant will be expected to file a report not later than the 15th of each month with the secretary of the Priorities Division, covering its activities during the preceding month. Failure to submit this report will cause such plant to be dropped from the preference list.

War Contracts Delayed by Lack of Facts

DETROIT, Sept. 10—The awarding of government contracts to concerns in this city and Michigan are being withheld because of negligence of some factory heads in returning the information requested in the questionnaire issued by the state division of the Resources and Conversion section of the War Industries Board.

At the present time the government is attempting to place contracts for large stamping operations and wood-working, but the Board of Commerce headquarters of the national board has not available sufficient details on the only plants which are in position to handle the contracts, and until such additional information is furnished no recommendations will be made to the government.

The great bulk of manufacturers have already filed the information desired, but a few large concerns and numerous smaller ones have not complied in filling out the questionnaires. Further steps in organizing the separate industries to facilitate plant surveys will be taken within a short time. Already the machineshop, stamping, forging and casting industries are organized.

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Ohio State Highways Transport Body

COLUMBUS, Sept. 10—Organization of the highways transportation situation in Ohio is to be put on a solid basis under the direction of the National Council of Defense. A complete state-wide organization is to be effected for carrying out the work which is being undertaken by the highways transportation committee of the Council of National Defense. The personnel of the new organization in Ohio has not yet been determined upon. There is to be a state highway transport committee of five members. There will also be a state chairman appointed with the approval of the Governor. The state will be divided into five districts, each of which will be under the jurisdiction of one of the five committeemen. These central committeemen will have under them local organizations to be known as district highway transport committees, with a chairman for each county. Headquarters will be at Columbus, and the committee in general will work under instructions from Washington. In each large center of the state it is intended to establish return load bureaus.

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Road Builders to Convene in Alpena

ALPENA, MICH., Sept. 9—Arrangements are being completed by the Michigan State Highway Department and its representatives for the holding of the State Highway Department and Commissioners Road Convention in this city on Sept. 16 and 17. It is expected that the members of the county commissioners and most of the highway commissioners of the townships of thirteen counties will be in attendance.

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Women Workers in Demand

WASHINGTON, Sept. 7—Increasing demands for women workers is reported from every section of the country. It is stated in one report that it is almost impossible to find women for non-war industries which pay wages lower than those offered by the war industries. The rubber factories in Akron and throughout Ohio are calling for and using considerable numbers of women, creating a shortage in other local industries in that state, according to a report. Growing demands for women for machine shops, munitions and light foundry work are reported. In the South there is a pronounced increased use of women for automobile tire repairing, elevator operating, etc.

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Government to Buy Platinum

WASHINGTON, Sept. 9—In order to secure sufficient platinum to meet the war needs, the Government has decided to go into the market and purchase jewelry or scraps of the precious metal at the rate of $105 per ounce. Citizens are asked to send their platinum to Raymond T. Baker, director of the mint. Platinum is used in great quantities for munitions manufacture, and the Government will regard the sale of private jewelry by individuals as a highly patriotic act.

A Government Employment Service Bureau for Women

DETROIT, Sept. 10—Four separate employment agencies for female labor have been amalgamated by the formation of the United States Government Employment Service for Women in this city, which has taken control of these bureaus. They are the Collegiate Bureau of Occupations, the Y. W. C. A. Employment Bureau, the Women's Division of the Employers' Association and the National League for Woman's Service. This bureau, which is under the direction of Miss Theresa Haley, aims to unite, coordinate and equalize women labor, and is conducted under the management of the Woman's Division of the Labor Bureau of the United States Government. There are bureaus in all the large cities of the country, with branches in the smaller surrounding towns and cities. It is the aim of these branches to adjust the supply of labor to the demand for it by directing women in localities where labor is plentiful to localities where there is a scarcity.

The bureau is divided into five branches—The Domestic Service Section, the Business Section, the Day Workers' Section, the Especially Trained Workers' Section, and the Factory Labor Section. The Detroit Branch already has branches in Saginaw, Traverse City, Grand Rapids, and Port Huron.

The bureau makes it a point to keep in touch with the civil service needs of the government. Every time an examination is announced civil service notices are also sent to the bureau, which not only inform applicants about these examinations but it advises and suggests as to which examinations are most suitable for the applicant, considering her education and training.

The Women's Division will not be confined to the war industries alone, however, as there is a big demand for woman labor in weaving, clothing and other trades.

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ROCKFORD, ILL., Sept. 6—The Bergie National Spark Plug Co. has opened a Pacific Coast branch office in the Monadnock Building, San Francisco. H. G. Smith has been appointed manager.

Calendar

ENGINEERING

Nov. 14-15—New York. Society of Naval Architects and Marine Engineers. Twenty-sixth general meeting. Engineering Societies Bldg., 29 West 39th Street.

ASSOCIATIONS

Sept. 19-21 — Syracuse, N. Y. Semi-annual meeting of the American Gear Manufacturers' Association.

Oct. 7-12—Milwaukee. American Foundrymen's Assn. and 5 allied organizations. Milwaukee Auditorium.

SHOWS

Sept. 8-20—Greely, Weld Co., Colo. Tractor Show, Central Community Fair.

Sept. 9-14—Milwaukee. Milwaukee Automobile Dealers, Inc. Fourth Annual Wisconsin State Fair. Hart J. Ruddle, Mgr.

Sept. 9-14 — Syracuse, N. Y. Tractor demonstration (State Fair). J. Dan Ackerman, Secy.

Sept. 9-15—Madison, Wis. Tractor demonstration (State Fair). O. E. Remy, State Fair Secretary.

Sept. 12-13—Marion, O. Tractor demonstrations, Farm Bureau Associations. M. C. Thomas, County Agricultural Agent.

Sept. 14-21—Chicago, Automotive and Accessories War Exposition. Municipal Pier.

Sept. 19-21 — Harrisburg, Pa. Tractor demonstrations, State Fair.

Oct. 1-5 — Washington, Ga. (Wilkes Co.) Tractor demonstrations, State Fair.

Oct. 12-19 — Atlanta. Tractor demonstrations Eastern State Fair and Automotive Exhibition.

Oct. 14-27—Dallas, Tex., Seventh Annual Texas Automobile Show. Texas State Fair.

Sept. 17-20—Riverhead, L. I. Tractor demonstration (County Fair). Harry Lee, Secy.

Sept. 30-Oct. 4—Trenton, N. J. Tractor demonstration (Trenton Fair). Harry B. Salter, Supt.

Oct. 16-18—Ottawa, Ont., International Plowing Match, Tractor and Farm Machinery Demonstration. Experimental Farm.

Oct. 30-Nov. 4—Shreveport, La. Tractor demonstration. State Fair.

Nov. 11-16—Phoenix, Ariz. Tractor demonstration, State Fair.

RACING

Sept. 21—Sheepshead Bay.

Oct. 5 — Cincinnati. Cincinnati Speedway.